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THE CENTRAL STATION SITUATION.

It is now a well known fact that central station business is passing through a period of somewhat restrained growth. The immense annual increase of the last decade of the nineteenth century has in the past few years subsided to more modest figures. Perhaps this is merely a manifestation of the general law that demand for any commodity is limited and must ultimately be filled by the supply, but the central station business is one in which we are very keenly interested, and we purpose to make a careful examination of the existing conditions with a view of seeing in how far they proceed from general economic causes and in how far from causes that may fairly be called preventable. Every industry responds quickly to the influence of both external and internal causes. It declines when the demand for its product falls off through changes in fashion or through the competition of similar products, or when through unwise administration the market is not met in price or quality. It improves on the other hand when the general market quickens, competition is overcome or improved technical and business methods are brought into action. In our judgment the present central station conditions are the result of various causes, no one of which can be charged with anything like exclusive responsibility. We have no panacea to offer, but we intend to take up seriatim some of the sociological, financial and technical questions involved in the hope of at least suggesting remedial measures. The central stations of the country represent an enormous invested capital which should be, through improvements in the art and through the rapid growth of the country, increasingly productive. If it fails to show the returns apparently justified there must be good reason therefor, and we hope that our friends in the business will aid our inquiry by such suggestions as seem pertinent.

SCARCITY OF WATER FOR CALIFORNIA PLANTS.

The prolonged dry season in California has again shown up the weak points of the extensive water power transmission development in the state. Comparatively few power companies, with the exception of the California Gas & Electric Corporation, have large reserve water storage, and the Corporation itself has had its resources taxed by the fact that there has been practically no rain since last May. By making the most of the steam plants at Oakland, San Jose and Sacramento, the water shortage on the South Yuba and Standard transmission lines has been offset or minimized to a certain extent. By next summer there will be more storage capacity available, and the gas engine reserve plant now nearing completion six miles from San Francisco can be utilized in connection with the transmission lines. With two or three additional water power transmission companies heading for San Francisco, and the consolidation of power companies in the city, the time is not far distant when the various lines can help each other out in emergencies. Then the effects of exceptionally dry seasons, such as the present, will not be feared. There are yet a few watersheds high up in the Sierras where numerous mountain lakes fed by melting snows can furnish water power for future transmission plants that will not suffer from a diminished flow in summer. A good many transmission projects are in course of development, that will prove profitable, but reserve plants of extensive water storage will be necessary to tide them over such a season as the present. Such a situation emphasizes more than ever the vital necessity of large storage reserve in connection with most of the modern hydro-electric systems.

British Institution of Electrical Engineers.

The annual report of the Institution of Electrical Engineers of Great Britain has recently been published in the *Transactions* of that body. The Institution was founded thirty-four years ago, and is, therefore, thirteen years older than the American Institute of Electrical Engineers. The report shows that the total membership of the Institution in May, 1905, amounted to 5,671, an increase of about 5 per cent over the corresponding total for the year preceding. There are six classes of membership in the Institution, three of which had held their numbers stationary during the preceding year, or substantially so; namely, honorary members, foreign members and members. The associate members gained 175, but the associates lost a nearly equal number, equivalent, therefore, to a transfer in bulk from the lower to the higher of these two grades. The number of students increased nearly 20 per cent. The administrative activity of the Institution is reflected in the fact that no less than 87 council and committee meetings were held during the year, as against 17 general meetings. Twelve papers were read in the London meetings, and twenty-eight papers or addresses read at the section meetings are either printed or abstracted in the *Transactions*. There are six sections of the Institution in the British Islands, besides one in India and another in South Africa. These branch sections collectively initiate more papers than the London parent stem, and play, therefore, even more important a part in the proceedings of the body than do the twenty-five branch sections of the American Institute of Electrical Engineers. An important policy of the Institution is in the maintenance of scholarships and bestowal of prizes for papers. Six scholarships were awarded last year and twelve premiums for papers. Against this record the American Institute of Electrical Engineers at present offers only the Edison Medal. But on the other hand the sad state of technical education in Great Britain lends justification to a diversion of income to purely pedagogical purposes which would be lacking in this country.

Single-Phase and Direct-Current Transmission.

Although on the basis of equality of the measurable electromotive force between transmission wires, the three-phase is of all systems the most economical with reference to the weight of the conducting material, and while in this country it is the only system which has been adopted for transmission on a large scale, it is not proper to assume that there may not arise conditions under which other systems may prove more advantageous, as indicated by the installations of high-potential, direct-current transmission systems, to which attention was recently directed by Prof. W. E. Ayrton, in a lecture before the British Association for the Advancement of Science. Laying aside the claims presented by the advocates of the Thury system as to the relative advantages of maintaining a constant current in a series circuit, instead of attempting to maintain a constant electromotive force in parallel circuits, it is interesting to investigate the relative economy of conducting material of three-phase and direct-current systems. Although doubtless when solid dielectrics are used, the electric strain which can be withstood by a chosen thickness depends approximately upon the effective value of the electromotive force, with gaseous dielectrics the determining factor seems to be the maximum value of the electromotive force. Thus, if one assumes that the electromotive force is sinusoidal, an alternating e.m.f. of 7,070 volts is approximately equivalent to 10,000 direct volts so far as rupturing a certain thickness of air is concerned. In order that a three-phase system shall require the same total amount of conducting material as a 10,000-volt direct-current system it is necessary that the transmission e.m.f. be 8,660 volts. If, therefore, the assumptions made above are applicable to aerial transmission circuits, the three-phase system with the same strength of insulation can operate at only $\sqrt{\frac{2}{3}}$ of the measurable e.m.f. of the direct-current system, or it will require 50 per cent more conducting material than the latter system to transmit the same power at the same loss.

The seeming relative economy of the direct-current system, as outlined above, is based exclusively on the difference in the character of direct and alternating current. It is well in this connection to call attention to a few facts connected with the comparison of three-phase and single-phase system with reference to the required conducting material. If one assumes that the neutral point of the three-phase system is connected to earth, say through a water-resistance static discharger, and that metallic poles and cross arms are used, then the e.m.f. which each insulator must withstand is that between the line wire and the neutral point. It may be shown that all symmetrical transmission systems possess the same economy of conducting material, irrespective of the number of phases, when compared on the basis of equality of maximum measurable electromotive force to the neutral point. Since the single-phase system requires only two-thirds as many wires and insulators as the three-phase system, it would seem that for the transmission circuit treated exclusively, the former system possesses some advantages with reference both to the cost of installation and the simplicity of operation. Although polyphase generators are less expensive than single-phase machines, and for general power distribution polyphase circuits are more desirable than the single-phase, for alternating-current railway work, the simple single-phase system possesses features that should not be overlooked.

Contact With Dielectrics.

A recent number of the *Philosophical Magazine* contains a paper (abstracted recently in the Digest) by Mr. Rollo Appleyard giving the results of a research concerning the contact resistance between metal-foil and insulators. It is well known that when two cleansed metallic surfaces are brought into contact there is a certain small resistance in or near the contact surface. This contact resistance is especially noticeable when the two metals are different; but it exists even when the two metals are the same, and even when the surfaces brought into contact have been carefully planed and smoothed. This contact resistance has been found to diminish with increase in the pressure with which the contact is maintained. In the case of the accurate contact of cleaned smoothed surfaces of similar metal, under considerable pressure, this contact resistance is very small. The experiments described in the above-mentioned paper indicate, however, that when a conductor like tin-foil is brought into contact with a fibrous insulator like press-spahn, there may be a very appreciable contact resistance. This contact resistance tends to be reduced by pressure over the contact surface. The contact resistance is often so large that computed values of resistivity, or specific resistance, of an insulator, referred to a unit cube, from measurements made on sheets of the material coated with tin-foil electrodes, may be widely in error.

It appears that when the pressure upon the contact surface is increased to 400 grammes per square centimeter, the apparent resistance of the insulator becomes fairly uniform, and perhaps only about half that which appears under a very small initial pressure. When the pressure on the contact surface was increased in the experiments beyond a certain critical value, the apparent resistance of the insulator began to rise again. At the same time there was a danger of crushing the material, and the increase in resistance was attributable to a change in the structural condition of the substance, rather than to a reversed variation in contact resistance. As might be supposed, the effect of increasing the voltage between the tin-foil electrodes was to reduce the resistance, as though the mechanical

pressure were increased without increase in voltage. Of course, the electric force between the tin-foil electrodes would determine a mechanical pressure by electric attraction; but this would be too small to account for the results on the basis of increase in contact pressure. It is very difficult to ascertain the physical conditions of a substance at its external surface. It is, however, clearly evident that conditions exist at the surface which are very different from those existing within the mass of the material. The surface tension alone gives rise to remarkable phenomena. Some maintain that the layer of air immediately in contact with a metallic surface may be kept almost in a liquid state, by virtue of the tensions developed at the bounding surface. However that may be, it is certain that the electric contact between tin-foil and a dielectric may be very imperfect unless considerable pressure acts upon the contact. Moreover, a relatively small electric potential gradient is capable of exerting a sensible influence upon the remarkable local conditions in the immediate neighborhood of the discontinuity.

When mercury electrodes were substituted for tin-foil electrodes in the experiments referred to, the dielectric resistance was substantially the same with different voltages, and was also substantially constant during the continued application of the voltage. It would seem, therefore, that mercury is not only useful for securing good contact between a metallic cup and an electrode immersed therein, but that it is also useful for securing good contact with a mass of insulating substance. A curious series of observations is reported upon the retentive force between a tin-foil electrode and a sheet of dielectric material across which an electric gradient is established. The tin-foil tends to cling to the surface as though by electric attraction, after the voltage and electrification have been withdrawn, so that there can be no electric attraction, in the ordinary sense, remaining. This retentive mechanical force was found to increase rapidly with the voltage applied. The precise actions involved in this retentive force are not clear. The suggestion is made that perhaps small variations between the capacity of a condenser tested at different voltages may be due to more intimate contact between the electrodes and the dielectrics at the higher voltages.

THE PATENT QUESTION AGAIN.

We print this week another addition to the growing literature of discontent with the present status of patents. That reform of some sort is needed we have no doubt, but that reform is difficult is all too certain. The situation in which the American inventor finds himself is not an agreeable one. He obtains a patent which is granted after a search which is apparently rigid, and then is sued for infringement under prior patents which were well within the knowledge of the examiner who made the search and which were perhaps fully discussed with the applicant's attorney before the patent was granted. But the matter is now out of the hands of the technical experts of the Patent Office and before non-technical judges who have to pass not only on the legal questions involved but on technical matters of interpretation, viewed of necessity from the standpoint of a changed art in spite of the most conscientious effort to revert to the original conditions. No wonder that decisions often seem conflicting and unfair. The often suggested plan of technical advisors for the Court would afford some relief if carried out, but courts are slow in favoring such a step, both on account of the difficulty of securing unprejudiced advice, and by reason of the mass of patent law that involves the broad facts of the case in a haze of uncertainty. We think that the former difficulty is overestimated, for even in the case of the polyphase patents there could have been found at least half a dozen men quite as far unbiased by previous technical affiliations as the courts have been by the popular impressions of the situation.

However this may be, there is another side to the matter deserving of serious thought. Is not the view of invention taken by our Patent Office too liberal as compared, for instance, with the German view? And has there not grown up a laxness of interpretation which permits the existence of claims entirely without the real scope of the invention, as shown in the specification? If the claims of a patent were rigorously confined to the plain intention of the specification, there would be much less ensuing litigation. But through custom an inventor is permitted to draw a loose and vague specification, often expressed in terms designed to avoid clashes with prior art, and then to append to it multifarious claims constructed on the plan of writing down all the possible permutations and combinations of the details. To our minds the German plan of holding the inventor sharply to his specification and giving him claims bearing directly upon what is novel and useful in that specification is preferable to our own. One solution of the present difficulties indeed would be to draw the lines closer on the matter of invention and to estop infringement suits against the inventor who actually and rigorously follows the specifications on which his claims were based. It very often happens now that the specification is merely a nucleus around which other people's ideas are assembled in actual manufacture, so that the completed aggregation not only has wandered from the original intent but actually includes items belonging distinctly to other inventors and subject to their patents. If the now merely perfunctory phrase "substantially as set forth," were reinforced by insistence on a clear and definite specification and then rigorously enforced in the subsequent interpretation of the claims, there would be a great reduction of litigation.

The German system greatly reduces the number of patents allowed and perhaps attaches too great importance to what our courts have called "the expected skill of the calling," but it at least does not err in allowing loose generalized claims to slip through to become later a source of danger to really well defined subsequent inventions. And, moreover, while appreciating the suggestion that a Patent Court should be constituted in connection with the Patent Office, we fail to see why that office should have returned to it for review the results of its own mistakes. If the examiners are fully qualified and competent to interpret the patents ultimately brought before them as judges, they are also able to interpret the same patents when passing through their hands as examiners, and to refuse to pass specifications and claims which lack novelty or conflict with patents already issued. It rarely happens that a really pertinent reference is entirely overlooked by the examiner, and a reference over which the patent has been allowed should certainly not be permitted as a citation against it in litigation. If a patent once allowed were incontestable so far as the right to manufacture under it is concerned, and the Patent Office on its own initiative settled once for all in allowing the patent its scope with respect to prior patents, there would, to be sure, be fewer allowances, but litigation would be limited to exceptional and unusual cases in which there had been early public use, or in which there was dispute as to the real inventor. Such procedure is perhaps too revolutionary to be immediately practicable, but revolutionary steps of some sort are needed. A patent once issued ought to carry with it the highest presumption of full valadity and should protect its owner in the right of manufacture. It is not always easy to draw a line between two involved sets of claims, but the real fault is in passing claims so involved as to make the facts in the case uncertain. The existence of a complicated train of a score or two of claims is, save in very exceptional cases, a mere incentive to needless litigation.

No Electric Bid Entertained at Lowell, Mass.

Comment was made recently in these columns on the electric lighting situation at Lowell, Mass., and the award of a large gas contract there for street lighting. Considerable misinformation has found publicity as to the nature and scope of this contract, which was quite peculiar in the conditions of its granting. We are indebted to Mr. N. T. Wilcox, manager of the Lowell Electric Light Corporation, for the subjoined interesting explanation of affairs in Lowell.

"Regarding the street lighting situation in this city, would state that we are now operating 525 alternating-current arcs in the streets of this city, and have quite a number of 25-cp incandescent lamps in the towns adjoining the City of Lowell, which are tributary to our station.

"The law in Lowell in rather peculiar, in that the chief of the Fire Department, who is ex-officio Superintendent of Lighting, makes the contract for the street light, this being a heritage from the old gas days, when gas lamps were operated by the department. The contract does not become binding upon the city until approved by the Mayor.

"The present chief is a strong gas partisan, and early made the statement that the Electric Company should not have any more of the city business than at present, which you will note is the larger part of it. We determined if possible to obtain this business, making a bid strictly on its merits, and presented a contract to furnish 1,100 single-glower, 220-volt Nernst lamps at $22.75 per lamp per year for 4,000-hour service. The Gas Company shortly after submitted a proposition for $28.50 per lamp per year for the Welsbach burner type of lamp. This proposition was put up to the Mayor for examination without signature. The Mayor immediately returned the contract to the superintendent and furnished to the papers his letter accompanying the contract. The result was that there was a great deal of discussion in the papers, during which discussion the papers uniformly came out in favor of the electric light, as we had made several demonstrations on the street showing the superiority of this lamp. We even went so far as to make careful tests of the candle-power of the lamps in position and found that with a series of ten of the Welsbach lamps the average candle-power as operated was only 36 candles, which was unusually good due to the excellent maintenance conditions under which these lamps were operated.

"After the discussion had been on for some little time, and the gas people seemed to be getting the worst of it, the superintendent wrote to several gas lamp companies asking for sealed bids. The result of this was that but two of these companies furnished bids; the Welsbach Street Lighting Company of America made a bid of $26.75 per lamp per year for 4,000-hour service, and the Cleveland Lighting Company bid $24.20 per lamp per year for the same service. The superintendent publicly stated that no electric bid would be considered. After these bids had been received the Mayor agreed with the local gas company to approve a five-year contract with them provided they would meet our price of $22.75, which they did without delay. The whole proceeding was an arbitrary one and was severely criticized.

"Actual tests made by Prof. C. A. Adams, who also made the Welsbach lamp tests, showed that the Nernst lamps were much superior to the gas lamps, even after allowing for the depreciation, which, of course, was nothing as compared with the depreciation of the Welsbach burners.

"The principal argument brought up against us was that poles should not be placed upon some of the streets where we were not located. If it had not been for this and the extreme partisanship of the contract-making power, there would have been no doubt about our obtaining the contract, as if it had been submitted to popular vote I think there is no question but that we would have won 'hands down' and by a very handsome majority."

The Rejuvenated Sons of Jove.

The fourth Jovian congress of the Order of Rejuvenated Sons of Jove—the only fraternal organization of those engaged in the advancement of electricity—was held at Dallas, Texas, October 14, 1905, at which time the following officers were unanimously elected for the ensuing year: Jupiter, C. A. Newning, No. 2, Houston, Texas; Neptune, L. G. Reed, No. 200, Sandusky, Ohio; Pluto, W. M. Brooke, No. 18, Dallas, Texas; Vulcan, J. H. La Roche, No. 185, Cohoes, N. Y.; Mercury, C. B. Roulet, No. 213, Dallas, Texas; Hercules, P. R. Boole, No. 155, Chicago, Ill.; Mars, F. C. R. Spence, No. 67, Marshall, Texas; Apollo, J. P. Tufts, No. 71, Dallas, Texas; Avrenim, W. G. Handley, No. 152, Cincinnati, Ohio.

The Order of Rejuvenated Sons of Jove was born among the leading spirits of the Southwestern Gas, Electrical and Street Railway Association at an annual convention held at Austin, Texas, in 1899. Since that time it has grown with a rapidity astonishing to its founders—who were men from many States and holding responsible offices in the electrical world, although to date its meetings have been confined to the annual association gatherings in the Southwest and in Ohio. Mercury says on the subject: "The foundation of the Jovian Order was inspired to bring devotees of the science of electricity and its allied interests into closer communication and membership, to the end that information and learning might be more general and effectively diffused; that love and pride of profession might be installed in every heart; brotherly feeling engendered, and that ties and links be forged at the anvil of Vulcan, which shall lengthen until it shall encircle the globe—thus cementing its members in a common bond of good fellowship. Of the ritual nothing can be written. To enjoy its beauties and understand its lessons it will be necessary to approach the shrine of Jupiter and to become a Rejuvenated Son of Jove."

It is the intention of the present Jovian congress to hold rejuvenations at the next annual conventions of the National Electric Light Association, the National Electrical Contractors' Association, the National Electric Jobbers' Association and the Southwestern Electrical and Gas Association, at which time candidates are requested to present themselves for rejuvenation. Mythological basis, application blanks and constitution and by-laws of the order may be secured by addressing the office of Mercury, C. B. Roulet, Wilson Building, Dallas, Texas.

Electrification of the N. Y., N. H. & H. R. R.

Wm. S. Murray, electrical engineer for the New York, New Haven & Hartford Railroad, has issued the following statement on the electrification of the New York division of that road, the details of which have given rise to so much discussion:

Concerning the proposed method of electrification it is interesting to note the unsolicited general concordance of opinion on the part of certain engineers and gratifying in the main to note a temerity in expressing a concrete opinion of our decision.

Without a full appreciation of the relevant factors in the case one could hardly view with a more kindly eye a hearty endorsement of our conclusion than a condemnation of it. Certainly the first indication of a real engineer is his reservation of an opinion until all these relevant factors have, in the full knowledge of their true bearing, been assembled. To-day a conclusion is worth nothing that is not a compromise. A compromise is the true algebraic sum of all the relevant factors.

After six months careful study of the possible methods of electrification a conclusion has been reached. The work has been too initiative, the ground too new and the opportunity too exceptional not to have kept an accurate log upon the method of procedure. Were it possible to devote time to things other than an expeditious and careful continuance of the work begun we would gladly segregate this conclusion into its relevant factors and discuss it with those engineers who by the reservation of their concrete opinion have shown a silent wish to later agree or disagree with its plans.

To the two great electrical manufacturing companies who have placed the genius of their engineering in our hands for consideration we have nothing but the highest tribute to pay. It has been no mean privilege to make a minute study of their individual view point of the problem. It is true their analysis of the situation has dictated widely separated conclusions and those engineers who appreciate the trust imposed in this decision for the New Haven road can readily understand that the divergence of opinion has served only to double the responsibility of the conclusion, but by which the engineers for the New Haven road are in no way disturbed.

To those minds prone to a conclusion without the assistance of the relevant factors it may be a helping thought to say that

throughout the study of the New Haven's electrification the Central's plans have been a constant and most relevant factor. The conditions of the New Haven problem, however, are widely different. It has been deemed that alternating-current is pertinent to their proper fulfillment. Because the New Haven locomotives will be operative either on direct or alternating-current in no way emphasizes the importance of their interchangeability. The condition imposed in effect makes valuable the double characteristic. A criticism of the Central's plans is irrelevant and unnecessary; direct-current propulsion is the judgment of their engineers. Our concern is its effect upon us, and it is read in the direct-current characteristic of our locomotive.

Independent Telephony in New England.

A convention of the independent telephone companies of Vermont and New Hampshire was held at Hotel Wentworth, Woodsville, N. H., on November 2. There was a large attendance present from all parts of both States. The object of this convention was to form an independent telephone association of all companies in Vermont and New Hampshire, the aim and purpose of the association being to cement together in a firmer union all independent telephone interests in this section for the purpose of promoting uniformity of operation, maintenance and construction; to protect and defend all independent telephone interests by moral efforts, co-operation and such other available means as may be deemed advisable; to prevent the enactment of hostile legislation and any and all other purposes that are deemed to the best interests of the association and of the independent telephone movement.

An organization was formed and the following officers elected: H. W. Buchanan, Barton Landing, president; C. D. Eastman, Woodsville, N. H., vice-president; G. W. Buzzell, St. Johnsbury, Vt., secretary and treasurer. There were twenty vice-presidents elected to serve as committees of arrangements. The association will be called the "Vermont and New Hampshire Independent Telephone Association." The National Interstate Independent Telephone Association emblem, adopted at the national convention, held in Chicago last June, was adopted. Other meetings are arranged for the near future.

A Central Station Daily Newspaper in a Franchise Fight.

Central station managers will be interested in the manner in which the Maryville (Mo.) Electric Light & Power Company succeeded in keeping a gas plant out of Maryville, notwithstanding that the press, Mayor and City Council were enlisted in favor of such a plant. The Mayor and City Council maintained that the electric light company was extortionate in charging $8 per month each for 39 street arc lamps consuming 480 watts, and $2 per month each for nine 32-cp incandescent lamps. It may be added that the contract also provided that the City Hall should be lighted free of charge. Failing to come to an agreement, the lighting company was notified before the contract had expired that if the lights were continued after September 1 the company would be paid only $7 for each arc light. The Council also decided to make an investigation regarding the prices of gas and electricity in other cities of about Maryville's size and sent the Mayor, an Alderman and an attorney to investigate. Glowing accounts of the Council's investigation appeared in the Maryville *Daily Tribune*, which boiled with enthusiasm over water gas.

When the lighting contract expired the company, feeling that it was impossible to furnish the service at the arbitrary rate settled upon by the board, shut off the lights and the city was in darkness for ten days. The citizens of Maryville now took a hand in the situation and pressure was brought to bear on the Mayor, who called on the president of the electric light company one evening and requested that the lights be again turned on, stating that the city would pay the old rate until such time as the Council and the company might agree upon a price. This proposition was accepted.

Not many days after a Chicago capitalist appeared before the Council and requested a franchise to build a $70,000 coal gas plant. The Council thereupon went into executive session and passed ordinance No. 90, also signing a secret agreement wherein they pedged the city to enter into a 10-year contract with the gas company ten days after the ratification of the ordinance to light the city with 120 60-cp gas mantle lamps at the rate of $3,500 per annum. Just about this time the *Daily Tribune* decided that its glowing descriptions of water gas were all wrong and that coal gas excelled it as the glory of the mid-day sun does the gleam on the lightning bug. It was also startlingly discovered that such cities as Boston, Bridgeport, Brooklyn, St. Louis, Milwaukee, New York, Omaha and San Francisco had within recent years discarded electricity for street lighting and adopted gas mantle lights for economy and efficiency. Notices were posted calling for a special election to vote on "Ordinance No. 90, passed by the board October 23, 1905." Though the ordinance had not been communicated to the public, the notice concluded with the statement, "If you vote 'yes' it will be taken by the board that you have assented to the granting of the franchise in the manner and form and according to all the provisions provided by said Ordinance No. 90."

Failing to obtain justice from the press in Maryville the electric light company played a trump card and began the publication of the *Daily Gas News*. This was a four-page paper in regular newspaper form and appearance, having as its motto, "We favor a square deal." The reasons why the company took this step are best given in its own words, which follow:

"First, as we are in the lighting business we are naturally opposed to having the city lighting contract bodily taken from us without giving the public a chance to acquaint themselves with the provisions of the contract. We consider such action unfair to us.

"Second, we do not think it fair to the public, either, to attempt to wrest from the city a ten-year's contract without the citizens being aware of is nature.

"Third, from a standpoint of economy the light company has decided that the cheapest way to give the truth to the public is by means of a separate newspaper, since the *Tribune* refuses to print the arguments presented by the light company except at advertising rates. This journal, with its characteristic regard for the interests of the public, is glad to publish column after column free of charge for the gas franchise and against the light company, but when the light company presented its answer during the month of September it was charged $6.20 for the space, and its notice was placed in the patent medicine columns in as obscure a place as could be found. The light company has decided, therefore, that the cheapest and best way to acquaint the public with the truth of this matter is by a daily paper of its own.

"The reason, then, for our action is not fear of competition. We would not fight a reasonable FRANCHISE for a minute. We are not fighting gas; we are fighting the PLAN of the city officials and others who dictate to them in trying to wrest from the city an outrageous contract in an illegal manner."

The paper was ably edited and filled with material which struck straight from the shoulder, the people lined up with it and after four issues of the *Daily Gas News*, the Chicago capitalist withdrew his proposition to the City Council. The result is that there is no gas in Maryville, nor is there likely to be any for some time to come. The campaign was carried on by Mr. J. C. Donnell, the manager of the Maryville Electric Light & Power Company.

Comparison of Electric Traction Systems.

At the Brooklyn Polytechnic Institute, on November 8, Mr. Albert H. Armstrong, of the railway department of the General Electric Company, delivered a lecture on the "Influence of Traffic Conditions on Motor Specifications." Mr. Armstrong introduced the subject by pointing out the three broad classes of service conditions, namely, short haul service, long haul service and grade work. After briefly outlining the requirements to be fulfilled in each of these classes the lecturer presented definitions of the different types of railway motors, covering the direct-current series motor, the direct-current shunt motor, the three-phase motor and the single-phase commutator motor.

The direct-current series motor he defined as an all-around satisfactory motor, but not as good as one especially designed to fulfill special conditions. The installation of the direct-current shunt motor might be warranted under conditions where its ability to return energy to the line on down grades would be an important factor. The three-phase motor has two important characteristics in common with the direct-current shunt motor, as it also runs at

constant speed and returns energy to the line. In general the three-phase motor possesses qualities which cannot be ignored and make it preferable, under certain conditions, even to the direct-current series motor. The single-phase commutator motor, he said, consists essentially of a field and armature in series with each other and which are identical in construction with a direct-current series motor except that the field winding is distributed around the inner surface of the field, similar to a three-phase induction motor, instead of having poles on which coils are mounted as in direct-current motors. The armature is like a direct-current armature except that it is wound for 200 volts instead of the 500-600 volts standard for direct-current series railway motors. This 200 volts is the limiting potential for which such alternating motors of any magnitude can be designed—in fact, the larger the motor, the smaller the limiting voltage. While small alternating motors have been run successfully on 600 volts, as in air compressor work on alternating-current railways, they are not feasible for motors of say 75 hp and above. One additional feature in the field of this motor, necessitated by the fact that the armature turns carry alternating instead of direct current, is the use of a compensating winding to overcome the reactance of the armature winding. This is a series winding placed in slots in the pole faces in electrical space quadrature to the magnetizing winding of the field. The compensating winding is in series with the armature and carries the same current that energizes the armature. It is the counter flux set up by this winding that makes the armature non-inductive. The single-phase commutator motor has variable speed torque, so that its torque increases and its speed falls on up grades, producing a speed torque curve similar in every way to that of the direct-current series motor.

In certain classes of work the single-phase motor is a strong rival of the direct-current series motor. This rivalry is not due to superiority in design, performance, lesser cost or weight, but because the first-mentioned motor effects certain fundamental changes that greatly reduce the cost of the distribution system and line.

There is still another method of electric operation, namely, by motor-generators, which scheme allows the use of large induction or direct-current motors carried either on the locomotive or in a tender behind. A field for motor-generator operation has been opened up by the encroachment of electricity on the steam trunk lines, necessitating the employment of very heavy and bulky apparatus which cannot be placed under standard passenger cars, nor would it be practicable to have separate motor equipments for freight cars. The single-phase commutator motor carries with it certain restrictions in design which make it questionable whether it could be successfully operated and built on such lines. Where conditions are too severe for the consideration of the single-phase motor, or where the profile of the road or general characteristics are not suitable for three-phase motors, the direct-current motor has been considered for operation in connection with an alternating direct-current motor-generator set carried on the locomotive itself. In other words, as the direct-current series motor is excellently qualified to change electric to mechanical power at the highest efficiency and lowest cost in the least space, it may be advisable to install motor-generator sets and fall back on the old direct-current series motor where considerable restrictions are placed on space, weight or capacity of the locomotive.

Mr. Armstrong then discussed hand, multiple-unit and alternating-current potential control systems. Hand control, he said, practically reaches its limit when a larger equipment than four 50-hp motors is used, mainly because the controller becomes too heavy and bulky for the car platforms. Hence, for equipments above this capacity it is better to subdivide the control system, placing the main apparatus under the car, and actuate the motors through a series of contactors, which may be electrically or pneumatically operated. Alternating-current potential control is becoming the recognized method of controlling single-phase railway motors, the speed depending upon the potential supplied. This method is very economical and simple, the speeds being varied by changing the connections of the car transformer taps. For motor-generator work direct-current potential control is used.

A typical speed time run, Mr. Armstrong said, can be considered in several different ways. Taking it up in its fundamental state, it consists of a period of acceleration, a certain amount of free running and a period of braking. Given intervals must intervene between acceleration, running and braking, and the all-day duty of the motor consists of a repetition of similar runs. Mr. Armstrong exhibited diagrams showing typical speed-time curves and explained how the relations of the various portions are affected by the running conditions. For instance, when stops are frequent, acceleration must be rapid, and the motor must operate at a heavy load factor for a short time, while in interurban service high acceleration is less important and for the greater part of the run the motor carries a normal load.

Furnishing the Election Returns.

All over the country, as usual, the telegraph, the telephone and the electric light played a prominent part this year in furnishing election returns and in notifying the public of the broad results. Increased use was made of the telephone, and one of the most interesting exemplifications was that given by the Keystone system in Philadelphia. The Keystone Company, realizing that the interest in the election this year was as great if not greater than in the Presidential election, arranged to give out the returns in a special manner. One transmitter, the regular Keystone subscribers' transmitter, was used, the regular 24-volt battery supplying power. The primary circuit being connected through five master repeating coils, each of fifteen sec-

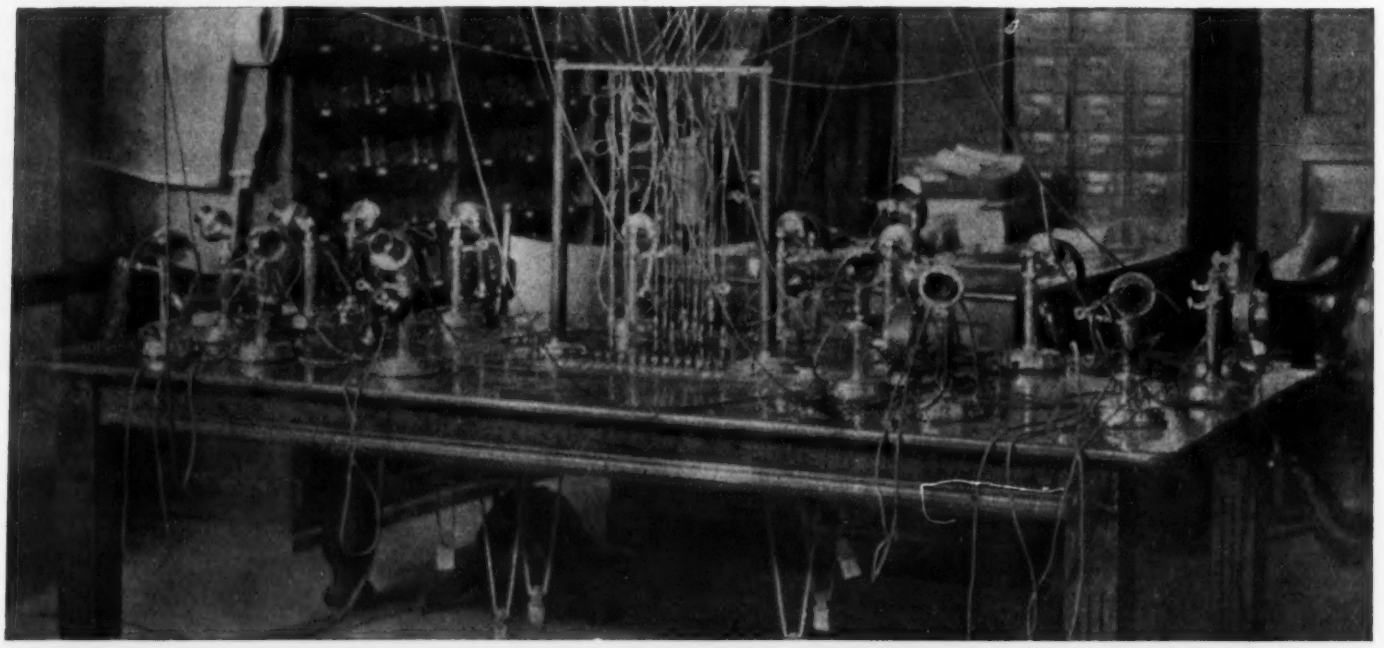


FIG. 1.—TRANSMITTING ELECTION RETURNS BY TELEPHONE.

ondaries were connected to a transmission circuit. Ten of these transmission circuits were connected to the local exchanges. The others were connected to Atlantic City, Camden, Trenton, Chester and the suburban exchanges of the Keystone State Telephone Company. Each of the transmission circuits upon reaching the exchange was connected to a repeater operating a local primary circuit through ten repeating coils feeding thirty secondary circuits. These secondary circuits were connected to the multiple jacks and the subscribers were connected with them in the regular way.

The continuous bulletin service started at 7 p.m. and ended at 1 a.m. The bulletins were received over special wires from the office of the *Evening Telegraph*, of Philadelphia, which paper placed its entire news gathering facilities at the company's disposal. The bulletins were written in duplicate, one copy going directly to the man operating the transmission circuit, the other copy going to the typewriters for duplication, all the returns and music being sent out over the one circuit, everybody getting them at the same time.

A special feature of the service was the concert furnished by means of a Victor talking machine, accompanied by an excellent selection of music. This feature was so successful that it is the intention of the Keystone Company to give similar concerts during

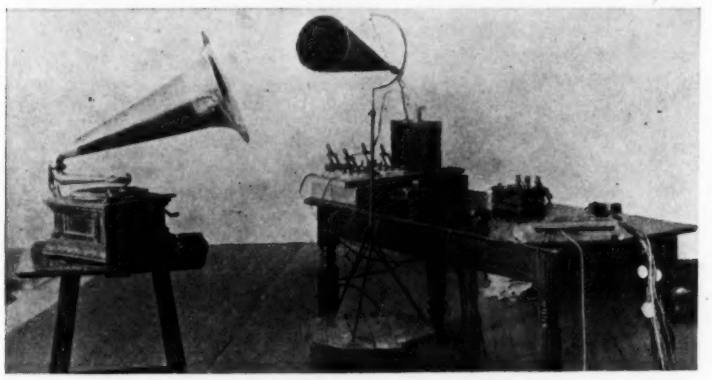


FIG. 2.—CONCERT BY TELEPHONE.

the winter. All the subscribers will have to do will be to take the telephone off the hook and ask the operator to connect them with the concert.

In addition to the continuous returns service, special questions were answered by the *Evening Telegraph* Information Bureau, Main 1800, by twenty operators, in connection with a special information bureau located at one of the exchanges, with a duplicate outfit with twenty operators. Special arrangements were made so that each of the operators could disconnect his instrument from the switchboard, leaving the plug hanging in the air in front of an operator that did all the plugging. This arrangement made it possible for the twenty operators to be located in any part of the room. These forty operators did nothing but answer special questions relative to the election.

During the evening it was found possible to use a transmitter with an ordinary mouthpiece and be heard satisfactorily by the thousands of people listening on the circuit, Atlantic City, Trenton and Chester hearing equally as well as Philadelphia.

As an evidence that the Keystone experts were satisfied in advance that their circuits would work all right, the only part duplicated was the master transmitter, a switching key allowing either one of two transmitters to be used.

Chicago Municipal Ownership.

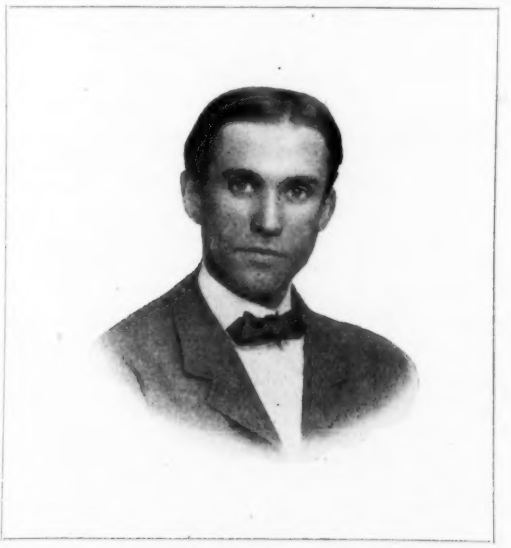
Another ordinance in behalf of municipal ownership of the street railways in Chicago was submitted to the City Council on November 13 by Mayor Dunne. The ordinance was accompanied by a message to the Aldermen which gave three ways in which Mayor Dunne asserted he would be able to bring about municipal ownership. The first plan is by reaching an agreement with the traction companies by which their property would be transferred to the city at a price decided upon by arbiters. The second is by condemnation of the property of the street railway companies under the provisions of the Mueller act. The third method is the Mayor's alternative to his contract plan, providing for the construction of municipal lines to parallel the lines of existing companies. The ordinance is drawn to place on ballots at the spring election the question whether the city shall issue Mueller bill certificates for $75,000,000 for reconstruction of lines and purchase of unexpired franchise rights. The ordinance was referred to a committee on local transportation, which decided the fate of the other propositions submitted by the Mayor in regard to municipalization of street railways. Another ordinance, submitted by Mayor Dunne, provides for 75-cent gas and lower electric light rates.

Electrical Engineers of the Times.—XXXVI.

MR. VAN RENSSELAER LANSINGH.

Van Rensselaer Lansingh was born at Albany, New York, in 1873, and received his early education in the public schools of the City of New York and in the College of the City of New York. In 1892 he entered the University of Chicago, from which he was graduated in 1896, having specialized in mathematics and physics. Two years later, in 1898, he graduated from the electrical engineering department of Massachusetts Institute of Technology, having also taken extra work in mechanical engineering during this course.

During the Spanish-American war Mr. Lansingh enlisted in the Second Regiment of United States Volunteer Engineers. At the close of the war, after working a short time in Boston, Mr. Lansingh went into the dynamo and motor testing department of the Western Electric Company, at Chicago, from which he was promoted to the engineering department of that company. In 1900 he resigned and traveled abroad, attending the Paris Exposition. Upon his return to this country he accepted the position of assistant to Mr. H. H. Wait, then assistant electrical engineer of the Western Electric Company, taking executive charge of the engineering



MR. VAN RENSSELAER LANSINGH.

department. In 1901 he resigned to engage in consulting and contracting electrical engineering in Chicago on his own account.

Believing that the importance of the branch of illuminating engineering was sufficient to justify a specialist in that line, he began to concentrate all his efforts upon it, and in 1901 put out his card as illuminating engineer, being probably the first engineer in the country to begin professional practice under this name, which was almost unknown at the time he assumed it. In the latter part of 1901, he took the agency for the Holophane Glass Company for Chicago, and began the exploitation of the Holophane globes and reflectors in a scientific engineering way. His success was such that in July, 1902, six states surrounding Chicago were added to his territory, and the V. R. Lansingh Company was organized in which Mr. Lansingh as engineer perfected a selling and business organization to supplement his engineering work. In 1903 his company was given all the territory west of the Appalachian Mountains for selling Holophane products. The following year the Holophane Glass Company underwent a reorganization, in which it was divided into manufacturing and selling departments, and Mr. Lansingh was made general manager of the sales department, which change necessitated his removal from Chicago to New York, where he now lives.

Mr. Lansingh's success in the commercial field has been due al-

most entirely to the fact that his methods have followed engineering lines. His contribution to technical progress has been important in directing attention to the importance of illuminating engineering and in steadfastly advocating the application of sound engineering principles instead of guesswork in the planning of artificial illumination. He is the author of a number of articles in the technical press, and in 1902 presented before the Northwestern Electrical Association at Milwaukee a paper on the "Best Use of Lights for Desirable Illumination," and in 1903 before the Western Society of Engineers at Chicago read a paper on the "Engineering of Illumination." Mr. Lansingh has been an associate member in the American Institute of Electrical Engineers since 1899. He is also a member of the American Electrochemical Society.

CURRENT NEWS AND NOTES.

NEW YORK ELECTRICAL SOCIETY.—Mr. O. S. Lyford, Jr., will deliver a lecture before the New York Electrical Society at 19 West Forty-fourth Street, Wednesday evening, November 22, on "The Electrification of the Long Island Railroad."

NEW TELEPHONE EXCHANGE IN NEW YORK.—On November 12 the New York Telephone Company opened a new central office under the name of "Bryant." Subscribers in the section of the city bounded by the north side of Thirty-ninth Street, the south side of Forty-ninth Street, the west side of Fifth Avenue and the Hudson River now receive service from the "Bryant" office. They were formerly included in the Thirty-eighth Street office service.

ANOTHER ELECTRIFIED ROAD.—The Pennsylvania Railroad Company has decided to go ahead with the plan to equip with electric power the old West Jersey & Seashore Railroad to Atlantic City and some of the suburban lines out of Camden. This was announced during the present week by Samuel Rea, third vice-president of the company, and chairman of the special committee having the matter in charge. He said it would take a year to complete the work.

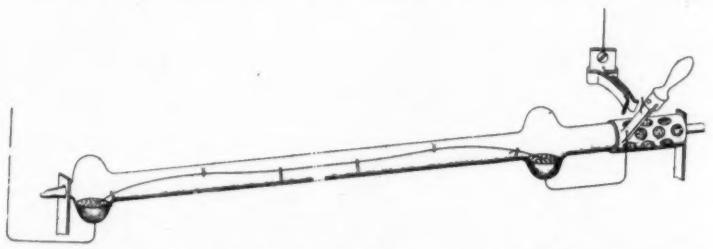
HIGH FRANCHISE PRICE.—Chief Engineer Nichols, of the New York Comptroller's Bureau of Franchises, has submitted a report to the Board of Estimate recommending that the Portchester Electric Railroad be charged for its franchise far in excess of any price heretofore paid. The rental is to be 10 cents per foot of single track for the first ten years and 20 cents a foot for the remainder, and also 3 per cent of the gross traffic receipts for the first ten years and 5 per cent thereafter.

LITTLE ELECTRICAL THINGS.—The New York Edison Company made quite a hit during the past week with its large "ad" in the daily papers: "Electricity for Little Things as Well as Big." It offers a number of excellent suggestions, aside from lighting, as to Christmas devices and presents; small power for the household, sanitary and labor saving, cleaning; the arc as a substitute for sunlight; the electric sign, etc. It is stated that more than 100,000 hp in electric motors is now furnished by the company, and that 4,557 hp was signed up in October. The "ad" is moreover takingly illustrated.

PRESERVATION OF NIAGARA FALLS.—It is stated that President Roosevelt will, in his annual message, make a strong recommendation to Congress on the subject of Niagara Falls. Officials of the American Civic Association called upon the President a few days ago and pointed out the alleged danger of the scenic beauty of the American falls being destroyed by the extensive development of electric power now in contemplation. The President, it is stated, expressed himself as willing to do all in his power to further the plans of the association and said he might bring the matter to the attention of Congress in his forthcoming message. It is thought that President Roosevelt's interest in the matter indicates that possibly before long the Federal Government will assume control over the Niagara Free Park and with the Dominion of Canada prevent any further inroads by power companies that might hurt the great cataract.

RATE REGULATION IN ILLINOIS.—Mayor Dunne, of Chicago, who, it will be remembered, was elected last spring on a platform of "immediate municipal ownership of" the street railways, having made little or no progress in that direction, is beginning to turn his attention to gas and electric light companies, and is attempting to get them to reduce their rates. A suit to test the validity of an ordinance regulating rates charged by the Peoria Gas & Electric Company is now before the United States Supreme Court. Attorneys for the city of Chicago have asked permission to file a brief in this case also.

STARTER FOR MERCURY VAPOR LAMP.—The accompanying illustration shows a device for starting mercury vapor lamps, as disclosed in a patent issued to Mr. A. D. Lunt, on November 7. The lamp tube is provided near its opposite ends with bulbs in each of which a certain supply of mercury is retained. These bodies of mercury before the lamp is started are electrically connected by means of a carbon filament. In order to start the lamp the handle is pushed so as to rotate the lamp and at the same time to bring the switch arm, to which the handle is attached, into engagement with the fixed switch member. As soon as the switch is closed current flows through the lamp by way of the carbon filament. Upon



further movement of the switch the upper end of the filament is rotated out of the mercury and there is formed an arc which extends along the tube and thus puts the lamp into operation. Further movement of the handle rotates the lower end of the filament out of the mercury electrode, and thus cuts the filament completely out of the circuit.

MUNICIPAL PLANT AT NEWARK, N. J.—City Counsel Coult, of Newark, N. J., has advised the Board of Works that under the existing laws it is not authorized to construct and maintain a municipal lighting plant, but that application for such power must be secured from the Legislature before proceeding in the matter. Mr. Coult's opinion was given in response to a request made by the board when the question of establishing a lighting plant, to be run by the city of Belleville, was recommended by the special committee appointed to look into and report on the whole question. Mr. Coult's opinion was in part as follows: "I have examined the laws of this State to ascertain whether any legislative authority has been given to you to raise or expend money to construct and operate works for public lighting. The power of this board over the subject of public lighting is found in a supplement to the act under which the board was organized, approved June 13, 1898, Laws of '98, page 491. This act amends Section 11 of the act creating the board, and is as follows: 'The Board of Street and Water Commissioners, by this act authorized, shall have entire control and full authority to provide for the public lighting of streets, avenues, lanes, alleys, highways, docks, bridges, public parks and buildings of such city under the government, control and management of any such board. * * * Said Board of Street and Water Commissioners shall be substituted for and shall be in the place of any board or authority in any such city heretofore or theretofore charged with the duty of lighting the said streets, etc. * * * The board created by this act in every such city is hereby invested with the exclusive power and charged with the duty of making contracts for the public lighting under its control and management as aforesaid, and for such term or terms not exceeding five years, as in the judgment of the said board shall be deemed for the best interest of such city, with the consent of the Mayor thereof; the board of authority of any such city having the power and charged with the duty of making and adopting the annual tax levy or tax ordinance of such city shall appropriate the amount necessary each year for paying the cost of such lighting or the fulfillment of any such contract or contracts.' * * * I am, therefore, of opinion that there is no law now which authorizes this board to contract for the construction and maintenance of a plant for public lighting and that application will necessarily be made to the Legislature if power is sought for this purpose."

UNDERGROUND TELEPHONE CABLES.—The Bell Telephone Company, of Philadelphia, and the American Telephone & Telegraph Company are laying Pupin underground cables between Wilmington and New York. The estimated cost of the work is $2,500,000. With other changes the cost will be brought up to $3,000,000.

TIME SIGNALS AT NIGHT.—The Western Union Telegraph Company, in addition to dropping the time ball at noon, now flashes each hour after dark a green electric light from the tower of its building at No. 195 Broadway. The light flashes precisely on the hour, and remains lighted ten seconds, so that mariners can take their reckoning either from the time the light flashes or from the time it disappears.

AN AMUSING SCHEME.—A special cable dispatch from Paris of November 11 says: "If Mr. Neill, a Canadian inventor, is successful in obtaining the telephone concession for which he is now negotiating with the French Government, America can prepare for an invasion of 2,000 Paris "hello" girls, who are pretty, of course. Mr. Neill, to offset the objection made against his automatic device that it would deprive 2,000 telephone girls of employment, has made a business proposal to M. Berard, director of the telephone service, to send the girls to Canada and the United States, where he undertakes to find husbands for them."

RADIUM ORE IN CALIFORNIA.—A despatch from San Francisco states that a deposit of uranium, or radium ore, has been found in Kern County by H. C. Jones. Mr. Jones declines to give the exact location, as it is on private property. Samples were shown of uranite, carnotite, black oxide, and pitchblende, all of which contain salts of uranium rich in radium. This is the first deposit of this ore found in California, and the second in the United States, others being in Gilpin County, Colorado. Mr. Jones says the ore is not in ledge formation, but is a deposit and evidently of volcanic origin. He estimates that it will take about 2,000 tons to produce an ounce of radium, which is worth about $12,000,000.

NOVEL NIAGARA DAM.—A concrete column erected in Victoria Park on the Canadian side of the falls after the plans of Isham Randolph, of Chicago, and designed to be a dam in prostrate form was tipped over on the afternoon of November 9 in the presence of a large crowd, many of them engineers, who had gathered to witness the event. The column was 7 ft. 4 in. square and stood 50 ft. high on a trestle that was 20 ft. above the ground level. Its approximate weight was 200 tons, and extending through the center was a heavy chain to keep the sections together after the column had been broken into six parts by wooden wedges inserted every 8 ft. The column was tipped by three jacks operated at the base of the trestle. It fell in nice shape, broke as desired, and raised the water in the intake 10½ in., which is believed to be sufficient for the needs of the city and the electric railway that use the intake jointly. This artificial barrier lies quite near the brink of the Horseshoe. It will be interesting to see how it withstands ice.

INDUSTRIAL DEVELOPMENT IN ITALY.—That Italy is rapidly assuming an important position among the industrial and commercial nations of Europe is shown by a recent report of Consul Cuneo at Turin. Her money is again at par and from her citizens in all parts of the world a steady golden stream is pouring into her banks and industrial institutions. The water in her hills is helping to regain a good deal that was lost because of the absence of coal. Power is rendered plentiful by her Alpine and Apennine streams. At the same time Consul Dunning, of Milan, points out that Italy's foreign trade is making remarkable strides, the gain in imports for the six months of 1905 being $9,873,135 over the same time in 1904, while exports increased $12,463,987. These increases indicate something of the rapid power of Italy to not only supply herself, either by first origin or by purchase at good terms, but also to enter many of the world's markets. Italy is determined to further extend her hold on South American markets and steps have been taken to bring the country into closer trade relations with Mexico. To place American goods in Italy means to meet the sharpest competition of wide-awake manufacturers, who are at last fully alive to their own capabilities and to the opportunities offered in their home territory.

OSCILLATORY-CURRENT RECTIFIER.—A patent issued November 7 to Prof. J. A. Fleming, of London, deals with the rectification of oscillatory electric currents for the purpose of allowing their values to be measured by means of an ordinary galvanometer. The patent is based on the discovery of the fact that if two conductors are enclosed in a vessel in which a good vacuum is made, one being heated to a high temperature, the space between the hot and cold conductors possesses a unilateral electric conductivity, and negative electricity can pass from the hot conductor, but not in the reverse direction. As the hot conductor should be heated to a very high temperature, say about 1,700° C., it is made of carbon, in the form of a filament such as is used in an ordinary incandescent electric lamp. The cold conductor may be of platinum or aluminum or else carbon. The two conductors are enclosed in a glass bulb similar to that of an incandescent lamp. The carbon filament is joined in a local battery circuit which serves to keep it heated to the proper temperature. By the use of two bulbs, so arranged that one permits negative electricity to flow in only one direction and the other allows negative electricity to flow in the opposite direction through it, it is possible to make use of the whole of the energy of the alternating current instead of discarding half of it. In this manner very feeble electrical oscillations can be detected by a sensitive mirror galvanometer.

JAPANESE COTTON MILLS.—Special Agent Crist, of the United States Bureau of Manufactures, in a report published by the Department of Commerce and Labor, says: "In view of the past favor which the output of Japanese cotton mills has met both here and in China, there is a strong tendency to turn to England to obtain the equipment for the enlargement and modernizing of the cotton weaving industry. This should be a fine opportunity for American manufacturers of spinning, weaving and power machinery to obtain a large share of this if they will send out expert men able to thoroughly demonstrate the economy, efficiency and simplicity of their machines. The situation is being closely watched by American importing houses having branches in New York, and there is a strong belief that steam turbo-generators, which are looked upon with high favor by the Japanese, with electric motors adapted to running looms or spindles in numbers of eight or ten, will meet with success. The engineer of the American Trading Company informs me he is making a close study of this question and that manufacturers of steam turbo-generators, motors or dynamos can obtain full information in regard to this matter by corresponding with the New York office of that company. I am also informed that this particular matter is being closely watched by representatives of English and German concerns."

THE WATER OF NIAGARA.—Resolutions passed by the International Deep Waterway Commission, recommending that no more franchises be granted for taking water from the Niagara River, the outlet of Lake Erie, and St. Marys River, the outlet of Lake Superior, have reached the War Department. Copies of the resolutions will be transmitted to the Governors of New York and Michigan, as the jurisdiction of the United States Government has been questioned. The extent of the authority of the Federal Government was discussed by the members of the commission at their recent session, and the opinion was expressed that the Federal Government undoubtedly had authority over water levels of navigable streams and lakes, although the title to the beds of the Niagara and St. Marys Rivers might be in serious doubt. It was declared that the National Government took undisputed control over the water level of Lake Michigan when the question was raised as to the right of the Chicago Drainage Commission to take water from Lake Michigan to drain the city of Chicago to the south and west, and finally to the Mississippi River. Possibly the point will be raised that in taking water from Niagara River below the rapids and at the Falls of Niagara, and from St. Marys River, below the Sault Ste. Marie rapids the levels of the lakes cannot be affected, and further, that the streams from which the water is taken are not navigable streams and for this reason are not under the control of the Federal Government. There seems to be no question about the authority of the Canadian Government to regulate the taking of water from the streams. It is stated that any action of the Canadian Government will be final, and that the regulation will not depend upon the provincial government of Ontario.

A LONDON WALDORF.—London is to have a superb "Waldorf" Hotel, with all the modern refinements in electric light, motors, elevators, etc. J. G. White & Co. are the contractors. An initial expenditure of $1,500,000 will be made.

"OPEN SHOP."—Mr. F. A. Swan, of the Swan Electric Company, Boston, chairman of the Ways and Means Committee of the new organization there to protect the interests of the "open shop" and push the campaign, informs us that it is desired and intended to issue an "open shop directory." Data are now being collected as to all "open shop" electrical contractors, and it is requested that such send their names, addresses, etc., to the Open Shop Committee, Electrical Contractors' Association, 88 Broad Street, Boston. Another meeting is to be held soon at the rooms of the Employers' Association.

AT THE COAL PIT.—It is said to be the intention to put in the center of the Indiana coal fields a large power plant for the generation of electricity which is to furnish all the power needed for the traction lines of the central and southern parts of the State. Those interested in the project claim that the power can be generated and transmitted to the sub-stations by electric lines more cheaply than the coal can be carted to the present stations and burned in separate plants. The first installation is expected to be in the neighborhood of 10,000 hp and the estimated cost is about $1,000,000.

ELECTRIFYING THE WEST.—A good deal of new railroad building is predicted, and it is certain that much of it will be electrical. It is noted that the extension of the rural telephone, which has reached over the Middle West to a surprising degree is to be followed by a trolley extension in the next half decade. The country communities are ready to vote bonds for trolley lines and there is said to be a rich harvest for the promoters first in the field. The railroads are trying to anticipate the coming of the trolley by placing gasoline cars on their branch lines, but this cannot interfere with cross-country electric lines.

OWNERSHIP AT LITTLE ROCK.—Municipal ownership of all public utilities, including the street railway, electric and gas lighting plant and telephone systems, will be demanded by the platform which will be adopted by the Socialists at the first city convention, which will be held at Little Rock, Ark., Thursday, November 23. It is said, also, that a plank will be included in the platform pledging the enactment of legislation for free legal advice, the abolition of the fee system in all courts, free medical attendance, pension for all public employes when disabled in the service, the establishment of municipal labor bureaus, bakeries, ice houses, wood and coal-yards and the abolition of the contract system for all municipal work.

NEW TYPE OF POLE.—According to the *Iron Age* a new system of electric line poles is attracting considerable attention in Europe. A wooden pole with spikes fitted in it forms a core. Around the outside of these spikes is wound a sheet of wire gauze of large mesh, while a layer of cement 2 in. thick is put over the gauze. This is found to make a very solid pole, which is not acted upon by the weather; it lasts as well as an iron pole and costs only about one-half as much. Cross arms are fitted by means of curved iron pieces bolted so as to embrace the pole. A line 30 miles in length has been erected. The poles are 45 ft. apart, measure 12 in. in diameter at the base and 8 at the top and are about 40 ft. long. The portion planted in the ground measures about 5 ft. in length.

PILING UP DEBT.—Sir Edwin Cornwall, chairman of the London County Council, has rather startled Londoners by the recital of some of the stupendous figures in his budget speech. Within sixteen years the debt of the County Council has increased from £17,563,262 ($87,816,310) to £44,620,266 ($223,101,330), and the amount expended on the local government of London is greater than that of Norway and Sweden combined, double that of Roumania and four times that of Denmark. But the Council has further debt projects in view. A new scheme of food relief is to cost over £4,500,000 ($22,500,000), and the Council is now responsible for the work that used to be done by the London School Board; it costs £4 1s. 3d. ($20.35) a year to educate a child in London. This is a higher sum than anywhere else," said Sir Edwin, "with the single exception of New York."

TELEPHONY ON THE COAST.—Mr. J. E. McGillivray, manager of the Lewiston-Clark Home Telephone Company, Limited, of Lewiston, Idaho, writes us as follows: "I wrote you some time ago that we had projected an independent telephone movement here and succeeded in getting in a very short time a larger number of contracts than the Pacific States Company had subscribers at this point. You made a note of it in your news column, and I now write you to give you further details of what we are doing. It has been decided to abandon the project of installing a local independent plant here. We all appreciate the harmful effects on a business community of having two telephone systems, and inasmuch as the Pacific States Company seems disposed to act in a very fair and generous spirit in reference to improvements, our local commercial club took the matter up and made a thorough investigation, after which they recommended that we retire from the field. The Pacific States Company have made a guarantee that they will install, within six months, a common battery multiple plant and improve their outside construction work greatly, provided the field is left clear for them. It was decided, after going into the matter thoroughly, that the best interests of the community would be served by taking advantage of their proposal and the matter is now a closed incident."

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—The Fifty-second meeting of the American Society of Mechanical Engineers will be held in New York City during the first week in December. The headquarters, instead of being at the Society House, 12 West Thirty-first Street, as in previous years, will be at the Edison Auditorium, 44 West Twenty-seventh Street, the two upper floors being used. The opening session at which President John R. Freeman will present the annual address will be held there on Tuesday evening, December 5. The second or business session will be held Wednesday morning in the main saloon of the steamship *Amerika* at the docks of the Hamburg-American Line at Hoboken, N. J. Following this session a special train will take those desiring to make the excursion to the new Worthington hydraulic works at Harrison, N. J. Wednesday evening there will be an illustrated lecture at the Edison Auditorium by Prof. R. W. Wood, of Johns Hopkins University on "Photography of Invisible Phenomena." The third session will be on Thursday morning and besides the presentation of professional papers there will be a discussion on the subject of "Bearings." Thursday afternoon there will be a reception at the New York School of Automobile Engineers, 146 West Fifty-sixth Street. The usual reception at Sherry's will occur on Thursday evening. The closing session will be held on Friday morning and will be devoted to the presentation of professional papers.

NEW HEATING SYSTEM IN CANADA.—United States Consul M. K. Moorhead, of St. Thomas, Ontario, sends an account of a new method of utilizing exhaust steam for purposes of heating. Two public buildings of St. Thomas are heated in this way by the exhaust steam of the engines used in the street railway and electric power houses. The steam is made to pass around small copper tubes filled with water, the hot water being conducted to the buildings in well-protected 4-in. tubes. The report says: "The exhaust steam is carried through a heater which is filled with small, corrugated copper tubes, these tubes being filled with water. In passing through this heater the water is heated to a temperature the same as the steam. Then, by means of a force pump, it is forced through a main pipe, 4 in. in diameter, to the buildings, where it is attached to the mains and the radiators in the buildings. There is also a return pipe which carries the water back after passing through the radiators, when it is again heated to any desired extent, the heating being regulated either by the speed of the pump or by control valves placed on the mains as they enter each building. The 4-in. mains and the return pipe which carry heat to the buildings are laid underground. They are covered with asbestos wool to prevent the heat escaping, and then wrapped with hemp packing and enclosed in a 12-in. vitrified tile with cement joints. The saving of this system will be practically the whole cost of heating the buildings with coal. There will also be the saving of the labor attending the firing of the furnaces."

Niagara Power in the Gorge.—I.

IT was a gala day at Niagara Falls. Music and celebration marked the turning of the first sod for the development of power in the gorge. This was in the summer of 1853. According to the plans of the promoters, water was to be diverted from Niagara River about one mile above the falls, led across the village of Niagara Falls by a canal, and then used to develop power by dropping into the gorge, some half a mile down stream from the American cataract. In this way a water head of nearly 220 ft. was to be obtained. This plan, as far as execution went, was then new.

During fully a century and a quarter, or since 1725, the fall along the rapids between the New York bank and Goat Island, which amounted to about 50 ft., had been utilized for lumber, grist and paper mills. But prior to 1853 no one seems to have been hardy enough to attempt the development of power in the gorge below the falls, though Augustus Porter is said to have suggested such a plan as early as 1842.

From that summer day in 1853, when the little village of Niagara Falls seemed about to develop the greatest water power in the world, it was a score of years before any useful work was done, and then the canal had been discharging water into the gorge, and thus

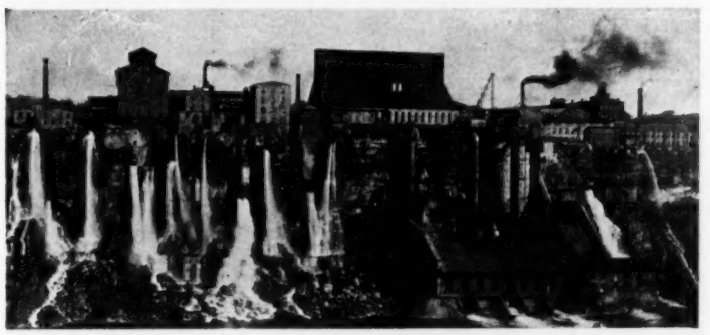


FIG. 1.—POWER HOUSES OF THE CLIFF PAPER CO. AND THE HYDRAULIC POWER & MFG. CO.

forming a miniature Niagara, for a decade. In explanation of this condition, it may be stated that the Niagara Falls Hydraulic Com-

FIG. 2.—WINTER VIEW OF GORGE BELOW NIAGARA FALLS.

pany, which began work on the canal in 1853, reached the limit of its financial resources in about 16 months, and work had to stop. In September, 1860, Horace H. Day secured control of the abandoned work, and completed a canal 4,400 ft. long, 36 ft. wide and about 8 ft. deep, on July 1, 1860. Then the Civil War arrested most lines of industrial development, and one of the finest water power developments on the continent remained unused during more than a decade.

In the year 1871 C. B. Gaskill built a gristmill at the lower end of the canal, excavated a wheel pit some 25 ft. deep from the top of the cliff, and then a horizontal tunnel from the bottom of this pit to the gorge. In this pit vertical wheels of 100 hp capacity were placed, and thus the development of power by the diversion of Niagara water from the upper to the lower river began. During twenty years, or until 1892, this type of development was multiplied along the edge of the cliff at the lower end of the canal, and the results may now be seen in the discharge from nearly a score of tunnels that enter the gorge from 100 to 175 ft. above the river level. Meantime the canal with terminal areas fronting on the upper and lower river was purchased by the late Jacob F. Schoellkopf and the late Abram Chesborough, in 1877, who organized the Niagara Falls Hydraulic Power & Manufacturing Company.

As developed by this company, the hydraulic site includes a frontage of 800 ft. on the upper river, a width of 100 ft. over the entire length of the canal, and a frontage of nearly a mile along the high bank of the gorge. The upper end of the canal on the river front has a depth of 14 ft., and at the lower end there is a basin 1,000 ft. long and 70 ft. wide near the edge of the cliff. In 1881 the first electric station of the Niagara Falls Hydraulic Power & Manufacturing Company, and the first to supply street and commercial lighting at the falls, began to be operated in what was then Quigley's Mill, now the mill of the Cliff Paper Company, with water from the canal.

Down to 1892 all the power developments with water from the canal, whether by the Hydraulic Company or its lessees, were made with pits sunk from the top of the cliff, and with horizontal tunnels running from the bottoms of these pits to the face of the cliff, as above described. In that year, however, the Cliff Paper Company decided to do what no one had done before; that is, build a power plant and mill in the gorge, some 200 ft. beneath the top of the cliff, and just above the river level. Prior to this time the development

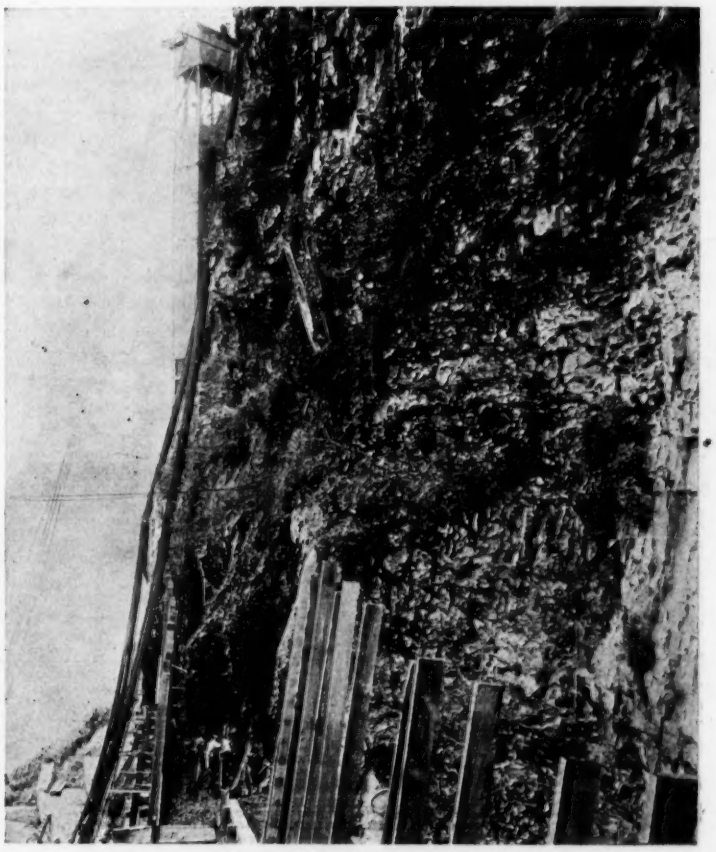


FIG. 3.—VIEW OF ALUMINUM CONDUCTORS, SHOWING CONCRETE FACING IN PROCESS OF CONSTRUCTION.

of power had been confined to the comparatively low heads of water utilized along the top of the cliff, because of the supposed difficulty of building turbine wheels to operate under water pressures of more than 100 ft. Twelve years earlier, in 1880, a prominent manufacturer of turbines had tried three times before he succeeded in making some 48-in. wheels strong enough to operate under a head of 83 ft., in one of the above pits.

In 1892 the Cliff Paper Company was utilizing water drawn from the canal in a wheel pit where the head was 75 ft., and the water was then discharged into the gorge. Water was charged for according to the volume used, and the paper company decided to more than double its power per cubic foot, by using the entire available head. To do this a penstock was connected with the tail water of the wheels in the 75-ft. pit, and by extending this penstock down the face of the cliff nearly to the river level a head of 125 ft. was obtained for another set of wheels there located, and using water which came down from those above.

Twenty-five hundred horse-power developed by this, the first plant in the gorge, is used to grind wood pulp. The penstock springing

from the face of the cliff, also the covered conveyor for the wood and pulp between the top of the cliff and the mill at its foot, may be noted in Fig. 1.

By 1895 the prospect for the sale of electric energy at Niagara Falls was such that the Hydraulic Power & Manufacturing Company decided to build another electric station, and what was more notable, to do what no one else at the falls had done, not only erect the new electric plant in the gorge, but also use in each set of wheels substantially the entire head of water afforded by the falls and upper rapids. The site selected for this first electric power house in the gorge was on a narrow shelf of rock 200 ft. below the top of the cliff and another 200 ft. above the bottom of the river that washes its edge, close to the pulp mill of the Cliff Paper Company. On this site the electric station was erected in three sections, the first of which began to operate on October 13, 1896.

In construction the electric station is a one-story stone building rising from a layer of hard limestone and capped with a steel truss roof. As to floor area, the station is 170 ft. long parallel with the river, and 100 ft. wide between the river and the cliff. Between the face of the cliff and the river, at one end of the station, a thick and high masonry wall has been built to protect the station from any possible damage by reason of the small mountain of ice that accumulates at the face of the cliff every winter, by the freezing of the tail water from its numerous tunnels (see Fig. 2).

The cliff at this point, as along most of the Niagara gorge, is made up of alternate horizontal layers of soft shale and hard limestone, which the action of water and frost is constantly disintegrating. As the cliff almost overhangs the electric station, it was decided a year or two ago to protect the latter by covering the entire face of the former with a layer of concrete, so that all danger of falling rock would be averted. This facing of concrete runs up the cliff 150.5 ft., and is reinforced at intervals by abutments that rise to about 78 ft. above the base. Steel rods with one end of each secured in the cliff run out horizontally into the concrete facing and abutments and serve to hold them in position. As the facing is nearly vertical along much of its height, the method of placing it was to erect temporary wooden forms at such distances from the face of the cliff as to give the desired thicknesses of concrete, and then, after cleaning the cliff, to fill in the space between it and the forms with concrete, as indicated in Fig. 3.

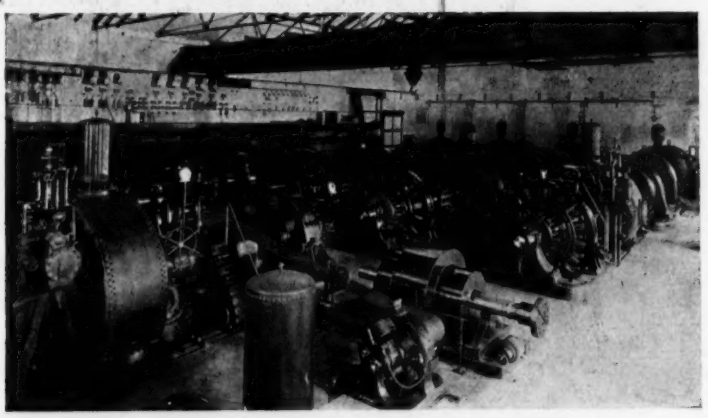


FIG. 4.—INTERIOR OF POWER HOUSE, SHOWING SWITCHBOARD.

On its interior the electric station consists of a single room with the horizontal turbine water wheels and direct-connected electric generators mounted side by side on the concrete floor. At the cliff side of the station and on a raised gallery is the switchboard, as shown in Fig. 4, and above all, spanning the entire width, is the traveling crane. Water wheels and electric generators are arranged in three groups or sections, numbered one, two and three in the order of their erection. Each group contains a row of water wheels at right angles to the river and the face of the cliff, and beneath each row of wheels there is a tail race which discharges into the river over a low dam, whose crest is at an elevation 344 ft. above tide water. These dams at the mouths of the tail races stand a few feet above the normal river level, and their use is desirable to maintain a fairly constant head on the wheels, because of the great rise and fall of the water surface in Niagara gorge.

Above the tail races the floor of the station is at such an elevation that draft tubes 25 ft. long are used with the wheels. In the forebay, at the top of the cliff, the mean low water level is 213 ft. above the crest of the dam at the outlet of each tail race, and the net head of water on the turbine is about 210 ft. This head is greater by many feet than that on the wheels of any other power station about Niagara Falls.

Water for the three groups of wheels in the station comes down from the forebay in three penstocks, one of which has a diameter of 8.5 ft., and each of the other two a diameter of 11 ft. The group connected with the 8.5-ft. penstock, which was the first to be installed, contains four pairs of Leffel wheels with a combined rating of 6,850 hp. Each of three of these pairs of wheels is rated at 1,650 hp, and the fourth at 1,900 hp.

One of the 11-ft penstocks connects with five pairs of horizontal wheels that have a total capacity of 13,200 hp. This capacity is made up of two sets of wheels of 2,300 hp each, two sets of 2,900 hp each, and one set of 2,800 hp. Five sets of wheels are connected to the third penstock and the total rating of these wheels is 13,300 hp, made up with two sets of 2,300 hp, and three sets of 2,900 hp each. These five sets of wheels are all of the I. P. Morris make. All the above turbines are of the horizontal type, and each has an electric generator direct-connected on each end of its shaft. Besides the above, there is one turbine of 250 hp, and one of 550 hp rating, both horizontal, which bring the total wheel capacity of the station up to 34,150 hp.

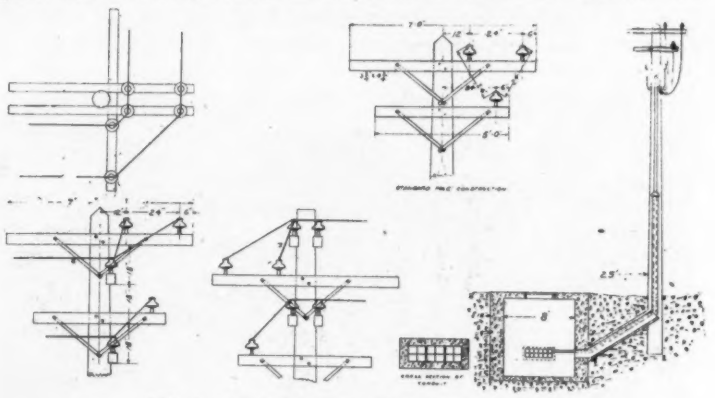


FIG. 5.—DETAILS OF TRANSMISSION LINE.

Each of the 11-ft. penstocks under the total head of 213 ft. is said to represent a greater power capacity than any elsewhere in the world. All of the turbine wheels operate with the effective head of about 210 ft. The 1,900-hp wheels operate at 300 r.p.m., the 2,800-hp wheels at 257, the 250-hp wheels at 600, the 550-hp wheels at 450, and all of the other turbines named at 250 r.p.m.

Each of the 1,650-hp wheels drive a pair of continuous-current Westinghouse generators that are rated at 280 volts, 2,000 amp. and 560 kw, individually, or 1,120 kw together. These six generators, with a combined capacity of 3,360 kw, supply energy to the Pittsburg Reduction Company, whose works are at the top of the cliff above the electric station. Connected to the 1,900-hp wheels are two 560-kw, 550-volt, continuous-current generators, and a belt from their common shaft drives 135-volt dynamos of 200 kw capacity.

One of the 550-volt generators carries a commercial load of stationary motors, and the other supplies current for the Niagara gorge electric road. A booster is also belted to this 1,900-hp wheel, and is connected in the feeder circuit of the Youngstown & Lewiston road, which extends 14 miles from the station. Power from the 135-volt dynamo goes to the National Electrolytic Company. Aside from the booster, the capacity of the electric machines driven by this wheel is 1,320 kw. Both the generators and the booster are of the General Electric make.

One of the 2,800-hp wheel sets is direct-connected to an 875-kw, 175-volt, continuous-current generator of General Electric make, which supplies power to the National Electrolytic Company, and also to a Bullock alternator rated at 1,000 kw and 11,000 volts, three-phase, which feeds into a distribution line for large power users. The total capacity of generators driven by this set of wheels is thus 1,875 kw. Both of the generators are direct-connected to one of the 2,900-hp pairs of wheels and were made by the General Electric Company, and their combined capacity is 1,875 kw. One of these generators, rated at 875 kw, supplies 5,000 amp. at 175 volts to the National Electrolytic Company, and the other, rated at 1,000 kw, develops 3,100 amp. at 325 volts for the Acker Process Company.

Another of the 2,900-hp wheels is direct-connected to a pair of General Electric generators, each of which has a capacity of 1,000

kw, 325 volts, and 3,100 amp., giving a total of 2,000 kw on this turbine, for the Acker Process Company. Each of two 2,300-hp pairs of wheels is direct-connected to a pair of 750-kw, 300-volt, continuous-current generators of Westinghouse make, and devoted to the work of the Pittsburg Reduction Company. The generator capacity of the two machines driven by each of these wheels is thus 1,500 kilowatts.

A third 2,900-hp wheel has a 1,000-kw, 11,000-volt, three-phase Bullock alternator at one end of its shaft, and a 700-kw, 2,200-volt, single-phase, Walker alternator at the other, giving it a load of 1,700 kw. The 700-kw alternator supplies a large percentage of the energy distributed by the Buffalo & Niagara Falls Electric Light & Power Company, which operates the electrical supply system in the city of Niagara Falls.

Each of the two remaining 2,900-hp sets of wheels drives a pair of 1,000-kw, 300-volt, continuous-current generators for the Pittsburg Reduction Company, so that there is a capacity of 2,000 kw connected to each set. A pair of 750-kw generators that supply current for the Pittsburg Reduction Company are coupled to each of the two remaining 2,300-hp wheels. Both the 1,000-kw and the 750-kw generators last named were made by the Westinghouse Company. The 250-hp turbine drives an exciting dynamo for the above alternators, the capacity being 150 kw at 125 volts. To the 550-hp turbine there is connected a 400-kw, 500-volt generator for commercial motor service. Including the exciter, the above list of electric equipment gives the first generating station in Niagara gorge a present capacity of 22,680 kw.

The two 1,000-kw, 11,000-volt, three-phase alternators above named, installed in 1902 and 1903, respectively, were the first alternating-current generators put into service for its own distribution lines by the Hydraulic Power & Manufacturing Company, though the 2,200-volt alternator supplying the local electric light company went into use at an earlier date. Power from these 11,000-volt alternators passes from the switchboard in the generating station through three-conductor, lead-covered cables to a terminal station at the top of the cliff. At this point the e.m.f. of a part of the power is transformed to 2,200 volts for nearby distribution, and the remainder is transmitted over a 11,000-volt, three-phase line to a large tract of land owned by the Hydraulic Power & Manufacturing Company, at the north end of the city.

The switchboard in the generating station, which is shown in Fig. 4, is about 100 ft. long. It contains 32 panels of Vermont marble and carries some very large switches. In spite of the variety of voltages at which continuous current is generated in the station, the switchboard is so arranged that there is a relay for every machine in case of trouble.

In addition to developing electric energy, the company supplies water from its canal for hydraulic power to the extent of 2,500 hp to the Cliff Paper Company, 700 hp to the Cataract City Milling Company, 2,200 hp to the Petebone Cataract Paper Company, 300 hp to the Oneida Community, Limited, 400 hp to the City Water Works and 1,800 hp to the Niagara Falls Milling Company, making a total of 7,900 hp.

As the electric generating capacity of the power company increases it is to be expected that some of the plants now using water from the canal at comparatively low heads will substitute electric motors for water wheels. In this way it is not improbable that the discharge of water from tunnels high up on the face of the cliff will be gradually discontinued.

After leaving the terminal station at the top of the cliff by way of underground cables, the 11,000-volt, three-phase circuits rise through the interiors of hollow wooden poles to junction boxes near their tops, as indicated in Fig. 5, and then run along a line of these poles to the land owned by the Hydraulic Power Company at the north end of the city. Each of these poles carries two cross arms and are arranged for two three-phase circuits. The cross arms are 3¾ by 4¾ in. in cross-section, and on each pole the lower arm is 5 and the upper arm 7 ft. long. Insulators for the three conductors of each 11,000-volt circuit are supported on one side of each pole, two on the upper and one on the lower arm, so that the lines connecting them form an equilateral triangle with 24-in. sides. From the lower outside edge of each insulator to the cross arm the distance is three inches, and the greatest external diameter of each insulator is about six inches.

The transmission conductors are of No. 2 hard-drawn copper wire, and they are insulated because of their location within the city limits. At one point the overhead line crosses the tracks of the New York Central Railway, and a sort of steel net is suspended beneath the 11,000-volt conductors. For the purpose of this net a pair of steel cables, each made up of seven No. 12 B. & S. gauge wires, are strung over the railway at a distance of nearly 3 ft. beneath the lower power wires, and about 8 ft. 7 in. apart. These cables are supported at the ends of a third cross arm on each pole, and about 5 ft. beyond each pole they are secured to a common guy wire. At intervals of about 10½ ft. along the span of this pair of cables they are connected by steel cross wires of No. 6 B. & S. gauge. This steel net is grounded by a wire that runs down one of the poles to which the net is attached.

At the north end of the city, on the large tract of land owned by the Hydraulic Power Company, the 11,000-volt line enters a transformer house, and a part of the transmitted power is reduced in pressure for distribution to the factories located there. Two of the largest of these factories are those of the Carter-Crume Company, and of the Central Machine Company. Motors of the following numbers and capacities are supplied with current by the 11,000-volt, three-phase line:

No.	Voltage.	H.P. each.	Total H.P.
1	11,000	875	875
1	2,200	100	100
1	440	75	75
2	440	50	100
3	440	40	120
6	440	30	180
2	440	20	40
1	440	15	15
2	440	7½	15
1	440	5	5
2	440	3	6
1	400	20	20
1	400	5	5
2	400	1	2
1	220	50	50
1	220	40	40
3	220	30	90
1	220	10	10
1	220	5	5
1	220	3	3
1	220	2	2
Total, 35			1758

Besides these motors that are supplied with alternating current, there is a large aggregate capacity in direct-current motors, operated by means of the two 500 to 550-volt generators of 960 kw combined rating, named above. Railway work is done by one 560-kw generator and a booster.

The three electric generators which are devoted to the work of the National Electrolytic Company have a combined rating of 1,950 kw, and two of them are competent to supply 10,000 amp. at 175 volts. A capacity of 3,000 kw and 9,240 amp. in three generators is devoted to the operations of the Acker Process Company, the pressure being 325 volts. In the plant of the Pittsburg Reduction Company, the output of eighteen generators, with a total rating of 13,360 kw and 37,866 amp. at 300 volts, is utilized. All three of these companies using large direct currents at low pressures have their works located not far from the edge of the cliff above the electric generating station of the Hydraulic Power Company in the gorge, and very large conductors are necessarily used to transmit the power from the generators to the electrolytic furnaces, as may be noted in one of the cuts.

Between the electric power station and the works of the Acker Process Company the distance is about 1,600 ft., and the current is carried by large bundles of aluminum conductors laid underground. The circuit from the generating plant to the furnaces of the Pittsburg Reduction Company consists of 60 copper cables of 500,000 c.m. each, and 100 aluminum cables of 1,000,000 c.m. each, in each leg, and, as seen in Fig. 3, these great conductors, without insulation, hang over the face of the cliff.

The Reichsanstalt Standards.

In a note, the London *Electrician* says that in January, 1904, the four standard manganin resistances were checked against the mercury resistance standards, and the average resistance measured was 1.001739 ohm at 18° C., as compared with 1.001741 ohm, the mean of the measurements of the previous 10 years. A number of experiments were (and are still being) made to determine the exact relation between the thermal and electric units, and it is stated provisionally that the gramme-calorie at 15° C. corresponds to 4.19 watt-seconds.

Heavy Electric Railroading.

By Bela Valatin.

THE well-known disadvantages of the direct-current traction system with a pressure of 500 to 750 volts in the working conductor, consist in the large capital outlay which the great current transmission and rotary converter sub-stations necessitate, and in the inconveniences and troubles caused by the position of the working conductor located at the track level when a third rail is used. These disadvantages have brought about a desire of solving the problem of electric traction by the use of other than the direct-current system.

The first new system to be adopted was the high-tension, three-phase system, which was put to practical use on the Valtellina line, an electric railway in Italy, and was also seriously considered for the electrification of the London Underground Railway. Three-phase current had already been employed on several railways in Switzerland, which were installed by Brown, Boveri & Co., and was also used on the Berlin-Zossen high-speed test line.

The high-tension, three-phase system had in the meantime been developed by Ganz & Co., and results have been reached which numerous electrical engineers had believed impossible.

There are, therefore, now three competitive systems, the direct-current, the single-phase and the three-phase, and it is possible that each will find adoption in particular cases. A comparison of the three different systems, particularly for such installations which are to be used for moving heavy train units and where electricity is to replace the steam locomotive, is given below. The principal points which enter into electric traction for main line railway service, and which determine the choice of any particular system, comprise the amount of capital outlay, the economy of operation, security of service, and flexibility of the system to meet the special requirements of traffic on a main line railway.

From a railway technical point of view it is of greatest advantage that the motor should make the same number of revolutions per minute as the car axle in order to avoid the energy losses otherwise caused by the gearing used to transmit the power from the motor shaft to the car axle. It is necessary, however, that the gearless driving motor be thoroughly spring suspended, as otherwise poor results similar to those obtained with the gearless locomotive of the London Central Railway might be expected. Where the motor has been flexibly suspended on the car axle, as is the case on the Valtellina motor cars, the results have been exceedingly satisfactory. With the newest type of Valtellina locomotive there is employed another way of driving the axle at the same number of revolutions, as the motor, viz., by means of a connecting rod. By this new method an advantage is gained over the direct-coupling of the motor to the axle, in that the motor is made independent of the locomotive axles and wheels. The mechanical efficiency of this new method is very high. Tests have shown that the use of connecting rods does not increase the friction losses over those due to direct connection.

Much has been said theoretically with reference to motor weights, but it will be admitted that the practical results obtained in actual construction of the various types furnish the only correct basis of comparisons. An examination of the single-phase railway motors

Comparison of the Weights of Electric Railway Motors.

No.	Name of Manufacturer, Type of Motor.	Name of the Line Where the Motor was Used.	HP.	RPM. = n	E.M.F.	Frequency.	Method of Driving.	Gear Ratio.	Weight=G Inc. Gears. Kilograms.	Weight=G Without Gears. Kilograms.	Weight Factor. n G / 100 HP.
		(A) DIRECT-CURRENT MOTORS.									
1.	Union & General Electric Co., "GE 57"		50	580	...	..	Geared	...	....	1350	157
2.	Westinghouse, "56"		55	475	...	..	Geared	...	1360	1222	105
3.	Siemens & Halske, D 17/30	Berlin Elevated and Subway	60	800	750	..	Geared	1:4	1575	1400	187
4.	Westinghouse, 56		75	490	...	..	Geared	...	1940	1800	118
5.	Siemens & Halske, D 19/30		85	720	750	..	Geared	...	1750	1550	132
6.	General Electric Co.	Central London, Motor Car, 1st Type	100	475	500	..	Geared	1:2.7	....	1820	86
7.	Westinghouse, 50 C		150	550	...	..	Geared	...	2400	2250	81
8.	Oerlikon	Freiburg-Musten Line Motor Car	150	400	750	..	Geared	1:4	3050	2700	101
9.	General Electric Co., "GE 55"	Central London Ry., New Locomotive	166	500	...	..	Geared	1:3.3	....	2460	74
10.	General Electric Co.	Central London Ry., Old Locomotive	200	152	500	..	Direct connected	...	....	5420	41
11.	Siemens & Halske, D 25/50		210	520	...	..	Direct connected	...	4800	4100	101
12.	General Electric Co.	N. Y. C. & H. R. R., Locomotive	550	300	600	..	Direct connected	...	....	....	...
		(B) SINGLE-PHASE MOTORS.									
13.	Oerlikon	Experimental Motor	35	1000	200	25	Geared	...	....	1000	286[1]
14.	AEG-Union, WE 31	Stubaithal Motor Car	40	800	550	40	Geared	1:5.07	....	1385	277[2]
15.	General Electric Co., GEA 604	Schenectady-Ballston Line	50	...	200	25	Geared	1:3.74	....	....	...[3]
16.	General Electric Co., GEA 605	Bloomington, Pontiac & Joliet Line	75	1500	200	25	Geared	1:4.3	....	2220	444[4]
17.	Siemens-Schuckert	Mürnau-Oberammergau	100	530	270	16	Geared	1:5	....	....	...[5]
18.	AEG-Union	Spindlersfeld Railway	100-120	800	6000	25	Geared	...	2360	2100	168-140
19.	Westinghouse	Swedish Government Locomotive	150	1270	200	25	Geared	1:3.88	....	2500	210
20.	Oerlikon	Proposed Locomotive	200	650-1000	...	15	Geared	...	....	3000	98-150[6]
21.	Westinghouse	Experimental Locomotive	225	300	140-325	..	Geared	1:5.27	....	....	...[7]
		(C) POLYPHASE MOTORS.									
22.	Brown-Boveri	Burgdorf-Thun, Motor Car	60	600	750	40	Geared	1:3	....	1500	150[8]
23.	Brown-Boveri	Burgdorf-Thun, Locomotive	150	300	750	40	Geared	1:1.88	....	4000	80
24.	Brown-Boveri	Jungfrau, Locomotive	120	750	500	38	Geared	...	....	2100	132
25.	Siemens & Halske	Marienfelde-Zossen High-Speed Ry.	250 norm. 750 max.	900	1150-1850	45-50	Direct connected	...	....	3200	123-41
26.	AEG.	Marienfelde-Zossen High-Speed Ry.	250 norm. 750 max.	960	435	50	Direct connected	...	....	4075	146-49
27.	Ganz & Comp.	Wollersdorfer Locomotive	75	600	3000	42	Geared	1:6	1440	1065	85
28.	Ganz & Comp.	Canada, Motor Car	120	750	1100	25	Geared	1:3.27	....	1750	109[9]
29.	Ganz & Comp.	Port Madoc, Locomotive	180	750	600	50	Geared and driven by coupling rod	1:3	....	1610	67
30.	Ganz & Comp.	Valtellina, Old Locomotive	225	128	3000	15	Direct connected	...	....	4900	28
31.	Ganz & Comp.	Valtellina, Motor Car	250	300	3000	15	Direct connected	...	....	3800	45.6
32.	Ganz & Comp.	Proposed Locomotive, Interurban	400	168	2000	14	Coupling rod	...	....	6950	29
33.	Ganz & Comp.	Proposed Motor Car, Interurban	350	900	3000	30	Geared	1:3.1	2800	2550	65.6
34.	Ganz & Comp.	Proposed Locomotive	600	225	3000	15	Direct connected	...	....	6700	25
35.	Ganz & Comp.	New Valtellina Locomotive Without Cascade Motor	600	225	3000	15	Coupling rod	...	....	8150	30.5[10]
36.	Ganz & Comp.	New Valtellina Locomotive With Cascade Motor	450	112.5	3000	15	Coupling rod	...	....	12400	31

[1]Street Railway Journal, 1905, IV., 8. [2] Elek. Bahn. & Betrieb, 1905, p. 297. [3]Direct-current and alternating-current motor. [4]Street Railway Journal, 1905, p. 812. [5]Elektrische Bahnen & Betriebe, 1905, p. 388. [6]Street Railway Journal, 1905, IV., 8. [7]Street Railway Journal. [8]Siegfried Herzog: Die elektrischen Anlagen der Schweiz, Vol. I. [9]Combined polyphase and direct-current motor. [10]Weight without Cascade motor.

Many engineers have believed that the three-phase system presented difficulties owing to the need for two overhead wires, and to the assumption that no suitable speed control could be found for it. They, therefore, welcomed the development of the single-phase commutator motor with which they could see the possibility of using only one wire and could obtain an easy and economical speed control. It had been the general opinion that the single-phase would be the ideal traction system for heavy train service, but a suitable motor had not been produced, as the single-phase commutator motor had not been considered suitable for this purpose on account of the destructive sparking.

After a few firms succeeded in constructing single-phase commutator motors which were not subject to destructive sparking, it was generally believed that there had been found a system which would supersede all others. The use of only one contact wire and also the starting without rheostat seemed greatly to influence the electrical engineers.

now in use, shows that their weight factor is generally twice as much as that of the heavy three-phase motors constructed by Ganz & Co.

The accompanying table gives a comprehensive comparison of traction motors of the direct-current, single-phase and three-phase types. The table indicates the output capacity of each motor when operated at a load which will cause an increase of temperature not exceeding 75° C. in one hour. The speed of the motor when operating at this load is also shown. It will be observed that the weight factors of the polyphase motors indicates that these machines give the best output for the amount of material used.

Experience shows that it is possible to design direct-current and three-phase motors of high efficiency with a small number of revolutions, for direct-connection to the driving axle, while the single-phase motor requires a speed reducing ratio in most cases between 5 to 1 and 6 to 1. The heavy weight of the single-phase motor also necessitates a large space for housing which peculiarity partly accounts for the inability to design a motor of large output and a low number of revolutions.

For the construction of large motors with a low number of revolutions, the three-phase motors are specially well suited owing to their ability of better utilizing the space, inasmuch as the collector rings can be placed outside of the frame, a construction that is practically impossible with the commutator motors. The weight of a three-phase motor is less than that of a direct-current motor, partly because collector rings of the former add much less to the weight than the commutator of the latter. The reduced efficiency, the corresponding increased losses, the larger commutator, the pulsating magnetic field, all cause the weight of the single-phase motor to be greater than that of the direct-current motor.

It has often been asserted that the reduced weight of the three-phase motor has been secured at the cost of security, by dangerous reduction of air-gap. The practical experience with three-phase motors has proven that this assertion is unwarranted and to confirm this statement it need here only be mentioned that the bearings of the motor cars of the Valtellina line after a service of 125,000 miles did not require to be replaced.

It has frequently been affirmed that the equipment for cascade regulation used by Ganz & Co. compares unfavorably in regard to weight with the control apparatus used in other systems. This assertion rests partly on the fact that the power for the low pressure (secondary) motor has to pass through the primary motor, so that the internal losses are increased under cascade connection. It has been found, however, that even with the decreased efficiency of the primary motor the three-phase system is more advantageous than any system using other motors.

The statement that the cascade regulation involves a dead weight because at the maximum speed one motor is disconnected is by itself unsupportable. The cascade regulation is used principally to allow the ascending of grades at a decreased speed and to insure a higher economy at starting. In the first case, the cascade connection permits a greater drawbar pull without the great energy consumption on steep grades and it is no disadvantage if at a greater speed the reduced drawbar pull can be distributed over fewer motors, allowing some of them to be disconnected. In the second case, where the cascade connection is used for starting, it is an advantage that during the higher speed, when great acceleration is of no importance, the current consumption and thus the current rush is decreased by using a less number of motors.

There is, however, no difficulty in using all motors in parallel under high tension. Fig. 1 shows an arrangement, due to Koloman v. Kando, by which both motors can be used under high tension, and work in parallel at high speed. In cascade connection a transformer is put in circuit between the starting rheostat and the high-tension side of the secondary motor. This transformer is used only when starting, and it can, therefore, be very small, it does not influence the economy, inasmuch as the transformer losses simply replace a part of the rheostat losses. The fact that this connection has so far not been practically used proves the correctness of the previously stated argument in favor of cascade regulation with high-tension and low-tension motors.

It has often been claimed that the three-phase system could not be as economical as other systems on roads with a variable profile inasmuch as it operates at a constant speed on all grades. This, it is claimed, would increase the internal losses of the three-phase motors, and also their weight. Even if this statement could be substantiated, it would be found that the increase of weight would be of very little consequence. On the other hand, it will be found that the efficiency of the three-phase motor is generally so much better than that of the series motor, that the change in load does not greatly increase the internal losses. Fig. 2 shows the efficiency curve of the motors of the Valtellina motor cars. (The larger motors of the new Valtellina locomotives are much more efficient.)

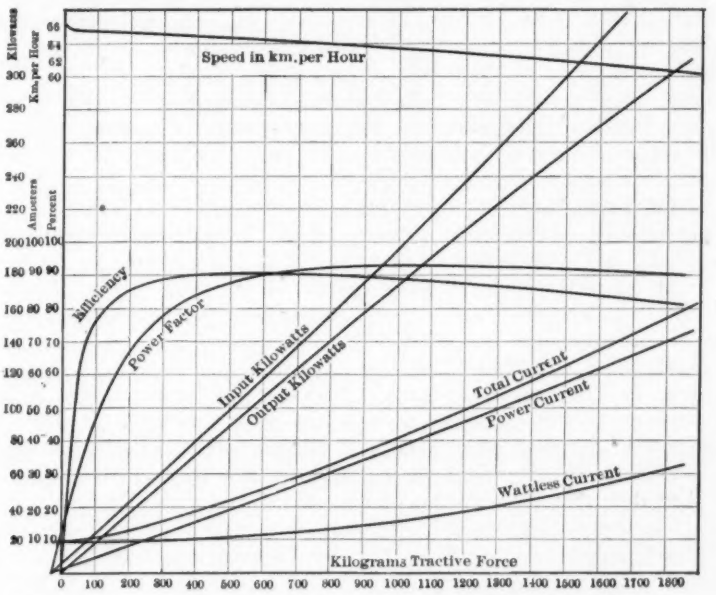


FIG. 2.—CHARACTERISTICS OF VALTELLINA 15-CYCLE, THREE-PHASE MOTORS.

The capital outlay for the electric equipment of the vehicles depends very much on the motor weights. The standard direct-current system has the advantage over the high-tension system, though the difference is not of importance. The single-phase system is, however, quite disadvantageous, requiring, as it does, a step down and regulating transformer, thereby increasing the weight and at the same time the capital outlay. Of further importance and unfavorable to the single-phase system, particularly with locomotives, is the pulsating torque of the single-phase motor, which does not allow

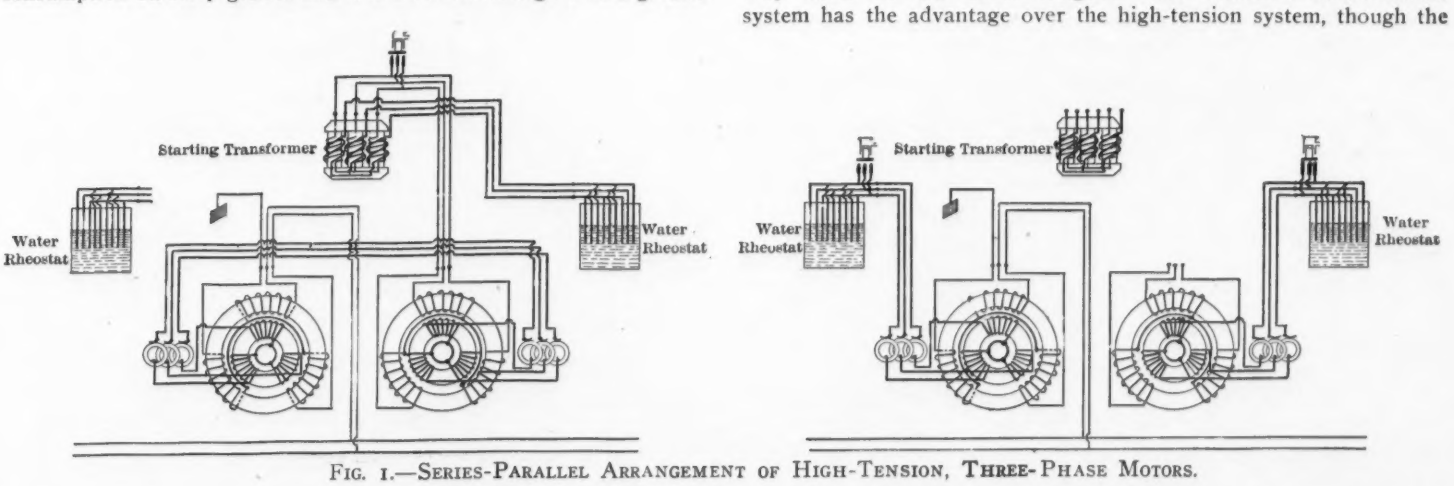


FIG. 1.—SERIES-PARALLEL ARRANGEMENT OF HIGH-TENSION, THREE-PHASE MOTORS.

a full utilization of the adhesion weight, thus requiring an increased locomotive weight..

With reference to the operating cost, the energy consumption for each of the three systems can cause considerable differences, particularly when water power cannot be obtained. In considering the energy economy of various systems, two kinds of railway service have to be judged, namely, those with few stops, and those with many stops. In the first case the economy in starting is of no particular importance, while for the second case it is of prime importance.

On lines where trains run long distances without stopping the single-phase motor is less advantageous than the direct-current and three-phase motors. The 225-hp series motor of the Westinghouse Company, according to recent publication, shows a maximum efficiency of 86 per cent, the direct-current motors of the N. Y. Central locomotives 93 per cent, and the three-phase motors of the new Valtellina locomotives 95 per cent.

Of much more consequence than the efficiency of the motors on railway lines with long distance stops is whether the energy transmitted to the moving trains on down grades must be mechanically braked, or can be returned to the line to be used by other trains. The recuperation is of special importance when the returned energy can be used immediately, this would be the case where there is a dense traffic or where the central station is also called upon to supply energy for other purposes than the moving of trains. The experience on the Valtellina line shows that the recuperation on light down grades is used to advantage even though no other train is simultaneously on the line to absorb the same.

On roads having frequent stops the starting losses are of great importance. With direct-current motors the start up to two-thirds of the maximum speed, is made by the use of the rheostat; beyond that speed the acceleration is accomplished without the rheostat. To stop the train the mechanical brakes are applied to destroy the kinetic energy of the train. The acceleration of the single-phase motors is accomplished by voltage control, thus avoiding the rheostat losses. The stop has to be made in the same way as with direct-current motors. Starting without the use of the rheostat appears ideal at the first glance. It should, however, be considered that the efficiency of a single-phase motor at a low speed is very much less than that of the direct-current motor, and that there are losses in the control transformer. As a matter of fact, the run diagrams of the Spindlerfelde single-phase road with voltage control show about the same energy consumption as has been calculated for direct-current motors. Still more unfavorable is the energy consumption for single-phase motors when the comparison is made on the basis of train-kilometer instead of ton-kilometer, on account of the electric equipment which amounts to about 7.5 per cent more than the direct-current equipment.

Single-phase has the advantage over direct-current of saving the transmission losses caused by the rotary converters, estimated at from 10 to 20 per cent. This advantage is also possessed by three-phase current.

With reference to starting, three-phase has the disadvantage that the rheostat losses are larger than with direct-current, inasmuch as the last part of the acceleration has also to be made by the use of the rheostat and not according to motor curve as is the case with direct-current. With the use of cascade regulation these losses can be reduced by half, but they are still larger than with direct-current. Three-phase current has, however, the advantage that when stopping a part of the kinetic energy of the train can be saved through cascade regulation. Experience on the Valtellina line shows that the recuperation obtained by cascade braking will offset the extra rheostat losses caused when starting.

With reference to the cost of maintenance of the electric equipment, exclusive of motors, there can be no important differences if the equipment for each system has been constructed in a workmanlike manner. It is otherwise, however, concerning the motor; the three-phase certainly has the advantage owing to the fact that no commutator is required. With the modern type of direct-current motors, the interruptions of service and repairs caused by the commutator are much less than formerly. Nevertheless, statistics show that even now most of the interruptions and repairs are traceable to the commutator. With single-phase motors, the chances of sparking and the dimensions of the commutator are greater than with the direct-current machines, hence the cost of maintenance must also be greater.

Of the high-tension systems the single-phase is particularly praised, because only one overhead wire is required. This advantage of the single-phase is being lauded particularly by the promoters of single-phase traction who claim that it simplifies the transmission line, that it is safer in service and considerably cheaper in first cost and in maintenance.

The existing installation of three-phase roads, particularly the Valtellina, have fully proven that the two-wire high-tension equipment fully conforms to the most severe exigencies for safety of service demanded by the important traffic of a main line railway, notwithstanding that the Valtellina installation employs wooden poles and a wire having a cross-section of 50 sq. mm. without longitudinal steel cable hangers. The experiences on the Valtellina have shown that the safety of service and durability of construction of the overhead equipment depend on the suitability of the current collector, and the cylindrical roller contact has given great satisfaction.

The air switches on the Valtellina line, even in station yards having 6 to 10 parallel tracks, have given very satisfactory results, and there exists no doubt that yards far more complicated can be equipped with this system to comply with the most intricate service.

The difference between the three-phase and single-phase system, with reference to the first cost of the contact wire, is due principally to the saving of a second wire, and in the consequent simplification of air switches.

It is worthy of note that with three-phase motors the trains on the line act as flywheels and thereby lessen the current rush. To illustrate this it may be stated that on the Valtellina from repeated plotting of the load diagram at the power house with 5 to 6

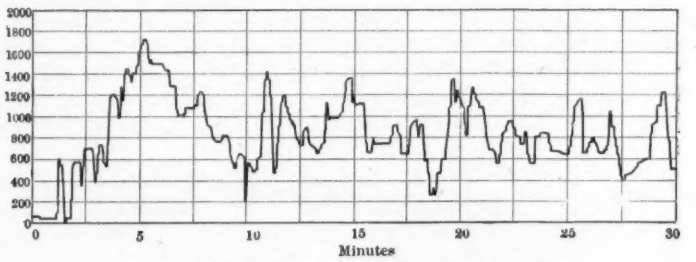


FIG. 3.—DIAGRAM SHOWING DEMAND FOR POWER.

trains simultaneously on the line (see Fig. 3) the ratio of maximum load to the average load has been found to be from 1.6 to 1.8.

In conclusion, it may be stated that for heavy electric traction the three-phase system is far superior to all others. If the single-phase system had not the advantage of requiring only one wire, instead of the two used by the three-phase, it would not be considered at all. Against the advantage of the single wire, there must be placed the lower installation cost, smaller weights of motor-cars or locomotives, greater security of service and less cost of maintenance on the side of the three-phase. In time these advantages will cause the present prejudice to be overcome.

Electricity vs. Compressed Air in Mining.

In commenting upon the assumed advantages of compressed air in comparison with electricity as a means for transmitting power in mines, Mr. W. R. Hulbert brings forward the following facts in a recent issue of *Mines and Minerals*. One of the most important advantages claimed for compressed air is that the exhaust air may be used for ventilation. It is to be noted, however, that while compressed air rock drills undoubtedly ventilate the mine with their exhaust air, analysis shows that the carbonic oxide gas formed in the cylinders is apt to have an exceedingly bad effect on the health of the workmen. The modern compressed air rock drill cannot use air expansively on account of the trouble due to the freezing up of the exhaust ports, and hence a large amount of power is thrown away. A small electric blower, requiring less than one-thirtieth the power necessary to operate a 3-in. rock drill, will effect all of the ventilation which would be accomplished by the exhaust from the drill. In general it might be said that a 3¼-in. electric drill will consume only from 2½ to 3 hp against 15 hp for an air drill of the same size. Taking into consideration also the fact that electric power is more economical in production and transmission, it would seem as though there ought to be a large field for its use in the mining industry in the future.

A Central Station Campaign at Niagara Falls.

The business of the Buffalo & Niagara Falls Electric Light & Power Company has very materially increased during the past three years. The organization of the working force is very efficient at all points, and the company finds that promptness, courteous attention and good service are material factors in making and retaining business. An example of the business getting methods of the comyany is shown in the system of following up new business, as outlined below. Immediately after the meeting of the Board of Public Works the company's contract agent secured from the office of the city clerk copies of all the permits issued for new buildings, and even before the owner of the proposed building has obtained his permit from the city, the solicitor calls on him and sets forth the advantages of electricity for lighting and heating purposes. The property owner having been shown that the company is interested in seeing that he has the most economical and most efficient system of lighting installed, he is informed that it will be glad to assist him in having the various wiring contractors submit bids for necessary wiring. This agreed to, notice is then sent by the company to all contractors in the city, stating that Mr. Blank will be ready to receive bids on the job by a certain date.

The company does no wiring and shows no partiality between contractors, and for this reason the contractors are retained as friends, and are ever ready to assist the company in popularizing the use of electricity. The company uses its influence to have all wiring bids reasonable, and in the interest of the owner they follow up the job, seeing that wiring is done properly, and in accordance with the Underwriters' rules. The solicitor impresses on the house owner the advisability of connecting up to the company's lines immediately on the completion of the building, also having lamps installed throughout. The company also arranges to install a meter, agreeing to charge only for the actual consumption until the house is occupied. This enables the owner to show his house in the evening, the only time convenient for many people to inspect it to good advantage. The installation of the lighting system has been found a material aid in the renting of buildings, and property owners are very ready to have this assistance in securing good tenants. The average man appreciates promptness and the lighting company endeavors to be prompt in all that it promises.

When the house is rented and the tenant moves in, the electric lighting service is there, ready to be used. The solicitor of the company calls and secures an application for lighting service from the tenant, at the same time taking the occasion to explain the advantages of the various small heating units, such as smoothing irons, chafing dishes, etc. After the contract is made the company is careful to follow up from time to time and see that the consumer is satisfied with the service. When a copy of the approved contract is returned to the consumer, circulars on cooking apparatus, etc., are enclosed, also a booklet instructing consumer how to read his meter. The introduction to this book reads as follows:

"Electricity is a commodity which is to-day as accurately measured as any other which is bought and sold, although to the person unacquainted with the subject it is enveloped in doubt and mystery. This should not be. We want you to know how the current we furnish you is measured in order that you may understand the invoices we render and may intelligently govern the consumption, and to that end we have given you, in the following pages, directions for reading the Westinghouse meter installed in your house or place of business, and a brief explanation of what it is and how it operates.

"We hope you will read this carefully and that you will occasionally consult your meter and note the rate and amount of consumption. It will give you a definite idea regarding the quantity of energy that is used and you will understand the accuracy and care we observe in rendering an account thereof."

This statement is impressive and inspires confidence in the consumer, who is assured that the company wants him to understand just how much current he is using and paying for. The effect has been to materially reduce the number of complaints as to the amount of bill rendered. With the copy of agreement is also sent a neatly printed card, which reads:

"We take pleasure in enclosing herewith approved copy of your agreement with this company.

"It is our constant aim to give our consumers perfect service, and we shall be glad to receive your suggestions on any subject pertaining to this end."

At the time of receiving the application, the solicitor impresses the prosjective customer with the advisability of installing low-candle-power lamps in the halls, basements and such places, where only a general illumination is required.

The company furnishes all incandescent lamps to consumers at cost. Where a house is being erected in a district not at present reached by the company's mains, the owner is advised to have his house wired, the company agreeing to supply him with current at the earliest possible date, when the business in the district warrants the extension; there are, however, few such cases, as the company has a line on practically all the streets in the city.

The company divides the city into contract districts, employing a solicitor in each district whose duty it is to follow up new business and see that all consumers are satisfied, etc. Small heating and cooking units are furnished by the company at cost.

A plan recently adopted for the extension of this business, and one which is giving eminent satisfaction, is an arrangement which the company has made with ladies of moderate circumstances and pleasing address, one residing in each contract district. These ladies are furnished with the heating and cooking apparatus at cost. In making afternoon calls they find it convenient to turn their conversation to electric irons, cooking utensile, etc., and to point out the excellent service given by them. They then mention that they are selling them, and will be glad to supply whatever is wanted. These women are not in the employ of the company, but are simply trying to make a little pin money in this way. They can, therefore, place apparatus where regular solicitors would not meet with success.

Another excellent plan is an arrangement with the various church and charitable societies of the city whereby the company agrees to furnish small cooking and heating apparatus at cost to them, and on all that are sold the societies make a profit.

It is found that to interest ladies in electrical apparatus designed for their use and convenience is to popularize electricity and cause conversational comment that is a help in selling appliances that consume current. Under this latter arrangement the company is also able to show its willingness to help the charitable organizations to profit by their labor. Not only are the ladies made customers, but also good friends of the company, and their good will is a valued asset.

The company is popularizing the use of small motors for all purposes. Many of the Niagara Falls barber shops have electric massage machines, butcher shops use electric meat choppers and grocery stores electric coffee grinders. In hotels electric carbonating apparatus is used, and many of the lemonade stands operate their shakers electrically.

Consumers who do not feel able to pay cash for motors at the time of purchase are given opportunity to pay for them on the installment basis.

All the Niagara Falls daily newspapers carry the company's advertisement, which is changed twice a week to keep it attractive.

The latest determination of the company to assure the customer that it is willing to be generous and reasonable in its charges is made clear by a step taken on November 1, when the following notice was attached to the bill of each consumer, with the head line:

"MINIMUM RATE REDUCED."

"The company has found that there is a growing demand for electric lamps for decorative purposes, etc.; and the installation of lamps in clothes closets, attics and such places has proved a great convenience. To enable our consumers to have these conveniences economically, we will, on Nov. 1, 1905, reduce the minimum monthly charge to $1.25 on all residence meter agreements, regardless of the number of candle-power of lamps connected. Lamps cut out under former minimum rate will be reconnected free of charge."

The company keeps a supply of cards bearing the names and addresses of all reputable wiring contractors in the city, and on these cards appear the following notice:

"Note.—The contractor must furnish you with a certificate of inspection from the Underwriters' Association of New York State, certifying that all wiring has been done in accordance with their rules and regulations."

The up-to-date methods employed by the company in the getting of new business and taking proper care of their consumers, has resulted in a very satisfactory increase in their connected load, which is at present about three 16 cp equivalent per capita.

The Patent Law Situation.

BY LUDWIG GUTMANN.

The comment of the London *Electrical Times,* reprinted in your issue of September 30, and referring to a letter over my signature, which appeared in the issue of August 26, entitled "The Patent Law Situation," shows that this subject can readily be misunderstood, and to correct some erroneous ideas, I beg leave to trespass upon your valuable space.

Few Americans, or American citizens, are dissatisfied with the way in which patents are granted by our Patent Office, or with the general organization, which is believed to be superior to that of other countries. An equally small number is dissatisfied with the patent laws of this country, and if patents after issue were to remain under the jurisdiction of the Patent Office, very little dissatisfaction would exist. The conclusions derived by your English contemporary are not quite fair, as the subject is general, and of too large scope to deal with individual interests. No laws can ever be framed that can be equally just to all, and that is well known and realized by everybody.

Great discontent has existed for some considerable time, and has caused some to abandon securing patents, others to direct their ingenuity into lines where secret processes of manufacture gave them greater security than patents ever have done; others again, discouraged by the expense incurred in defending the fruits of their labor, have abandoned the field of original work entirely. The existing defects are mostly outside of the patent law proper, and are due mainly to the fact that a patent after issue has neither the protection nor the guardianship of the Patent Office; but, like a ship that is launched from a shipyard, it goes out on the high seas of commerce, to be tossed about, and to fight its own battles.

It may be of interest to enumerate a few cases of hardships caused by "existing conditions" (not to be confounded with patent laws).

An inventor has made a desirable invention and obtains his patent. After a year or so he notices that one or another manufacturer uses his invention. He calls their attention to his patent and the result is, as experience has shown, a small firm is willing to recognize a patent and to compensate for its use. A large firm, on the other hand, rejects the offer, saying the patent is not good unless it has been upheld by the courts, or, in other words: "We will use your invention until you have beaten us in the court." The "court" does not mean "Patent Court," however, but an institution where a man sits in judgment permeated with "law" and honest intentions to be just, but who is for some cause or other not permitted to say that he is incapable of judging on a subject matter foreign to his experience and training.

Manufacturers frequently will not buy the patents, because they can use the invention for a long while before the fact becomes known to the inventor, and if such company is willing to buy it will offer a very modest sum. The actions of the officials show that they are not afraid of litigation, as they have attorneys by the year and with the present judges and courts, the chances are in their favor.

Another hardship results to small manufacturers from the endless number of patents granted on "modifications" of constructions, which any mechanic would arrive at in the course of his work. These should not be classed as inventions. At present they are so considered and are convenient means for harassing small makers by instituting suits for infringement.

Next may be mentioned the interpretation of claims. How these matters operate may be illustrated as follows:

Suppose a large firm has acquired the rights of some process of manufacture which is well covered by patents. After a few years some modifications are attempted by a competitor, which he regards to be outside the claims of the broad patent, when in fact they were actually infringements. A few years later a similar invention appears that is actually outside the scope of the broad patent, and the large firm begins to be anxious. It adopts a vigorous policy and its attorneys institute numerous suits. In a systematic way they attack first those makers whose cases of infringement can readily be proven; the latter, however, are prepared to fight, and both sides lose time and money; generally it takes several years before a final decision is reached. Sometimes the defendant sells its business to the complainant during such a fight, but the suit is not dropped. The absorbed firm is asked to put up a weak defense and loses the case. The court rules according to the evidence presented, and is, of course, unaware that the former opponents have now a common interest.

Assume that the company has three or four decisions in its favor. Now it becomes courageous, and studies the case of the manufacturer who is not infringing. The attorneys and experts for this company plan the case and work out a "line of analysis" to suit their purpose, "to explain to the court the nature," having as an excuse, of course, the well-known fact *that the court does not understand the theory.* The juggling done is amazing, and the court grasps the improvised "science." To help him out further his particular attention is called to the decision of former infringement suits with other makers, whose devices and purposes may have been entirely different from the present case. The court, after receiving the voluminous case, studies and compares both sides, and the more he tries to get hold of the theory and differences of the contesting parties the more mystified he becomes, and he argues somewhat as follows:

"Here is Judge X who upheld the patent in New York and Judge Y in Indiana gave a favorable decision. Can I put myself up to be more capable than these able and learned judges?"

Courts judge and are influenced by precedents. The decision of a court under such conditions can hardly be wondered at.

Let us now take the concrete case mentioned by the *Electrical Times.* Suppose a court is sitting in judgment and both sides send in their evidence. Now let it be provided by an act of Congress that all technical matters must be sent to Washington to a lower patent office court, which may be made up of former commissioners, examiners, etc., etc., permanently or temporarily connected with such a court. Would it be difficult for two or three of the examiners of the present Patent Office force, who have had polyphase patents to examine for three or four years, to know in any particular case submitted to them who is infringing, what the claims really cover, and whether the scope of the claims is not stretched by the complainant? It seems to me a logical conclusion that those who can grant patents must be able to judge, especially as they make it their daily business.

If the present system is in part to be continued the judge would make his ruling so far as he is competent; but would it not be well to have all technical matters turned over to a Patent Office Court, or a department of officials who do not require to be educated by primary methods for the occasion? In order to judge wisely the subject matter should have been understood for a considerable period, which cannot be expected in the brief time of the trial. On this point a well-known St. Louis jurist expressed himself as follows:

"In order to have sound judgment in any domain of reasoning the matter considered should have been previously assimilated and transfused into the mind that reasons thereon, so that every element thereof should be valued in due proportion with all other considerations bearing thereon."

This statement is to the point; in all matters in which courts are *versed,* they show sound judgment, but in matters that take years of training it can hardly be expected that a court can have "sound judgment" or absorb "science" by reading or studying for three or four weeks a subject unfamiliar to it. The opposing parties to a suit could employ experts if they choose, or do without them. If the case is certified by the trial court to the "technical court" or department in Washington, this latter court should try, consider and determine the precise points submitted to it, and counsel should be notified, to have an opportunity to submit oral and printed arguments.

This technical department or court is not to decide questions of law, but questions of fact. The Patent Office library is at its disposal, and so far as knowing the state of the art is concerned, no one has ampler resources. For this reason it is much less influenced by opinions on either side, and will not accept an unfair interpretation of a claim nor allow an enlargement of the scope of the patent, abuses which are fostered by the existing system.

Under such a system, where examiners versed in their specific departments as just outlined are employed, the necessity of "experts" dwindles down considerably. The selection of the judges in a patent court might be made without public notice, should there be any fear that they might be subjected to undue influences, and justice may be expected under such conditions more speedily than under the present state.

Suppose the owners of the polyphase patents mentioned by the *Electrical Times* could have the infringement suits tried before a

court consisting of the examiners that granted the claims, they might have had decisions thereon in their favor within a year or two instead of five or ten years' litigation. The complications arising in England and Germany are unfortunate and should be avoided in any system that is to take the place of the present system here. Two ways occur to the writer at present, and no doubt others better qualified may be able to find better ways or suggest more suitable means.

Suppose that a department, or advisory board, were created in the Patent Office for the purpose of rendering assistance when called upon by the courts. This department receives the cases of the opposing parties from the courts, studies them and gives a summary to the courts, which summary will guide the judges in their decisions. Those conclusions of the Patent Office Advisory Board could be or should be incorporated in the decision rendered. This advisory board of the Patent Office may be presided over by the Commissioner of Patents, or some official duly appointed, while two men are given the task to study the case on both sides. They may discuss and weigh the merits of the different points brought forward by both parties, and if their views are the same they make a report to the Commissioner of Patents, or superior official, after a hearing is given to both sides, and draft the reply to the court seeking the information. If the two investigators have different opinions, they bring these points before the superior officer, who becomes a member, and the decision of the greater number is reported to the court. There is something in favor of a secret Patent Office Board, whose examiners may be changed for each case, and whose names do not appear. Not only would any undesirable influence be avoided, but the examiners would act more independently.

The second is a lower patent office court, to whom all technical suits must be reported, and which decides the technical side of infringements, rights or wrongs, and at this stage turns the subject over to the proper court for the civil actions resulting from the finding. Here again the examiners, who are supposed to be technical men, should be persons who know the subject they are dealing with, and if they do the selection of experts for presenting the cases (which question seems to be the all-important one of the *Electrical Times*) drops out entirely. For the party that is not infringing, although accused of such act, can generally show this without great effort, and any attempt made by capable lawyers and experts to deceive will avail them nothing. It would be wrong to draw conclusions from the statements of results observed in England or Germany. Those conditions do not fit the American case. The English patent is granted without great search and strictness to any applicant; the class spirit of German professors does not find fertile ground on the American continent, while all the desirable qualities enumerated in the *Electrical Times* for an expert are found in the officials that would form such advisory board or Patent Office Court.

The questions raised are of interest to many and many should contribute their views freely. We are singularly fortunate in having an administration like the present, which makes the solution of such questions as these its duty, if they are shown to be weighty and of importance. This very point, however, can only be shown by a hearty and vigorous response and co-operation. The opinion of others is invited.

Resistance of Submerged Wires.

In a recent issue of *Comptes Rendus*, E. Rogouski reports the results of tests which showed that when thin bare silver wires are immersed in flowing water kept at a uniform temperature, and the current through them is gradually increased, the resistance decreases at first and then increases again. He gives a satisfactory explanation, based upon the presence of a molecular layer of water adhering to the wire. This layer prevents the temperature of the wire from becoming that of the surrounding water. It allows it to rise above it, and the resistance measured is not that of the wire at the temperature of the flowing water, but the resistance at a temperature a few degrees higher than that, and therefore greater than the value sought. When the current becomes stronger, the difference of temperature on both sides of the molecular layer increases, and when it becomes about 4° the layer breaks up and allows the water to flow in immediate contact with the wire. The resistance of the wire is then the true resistance at the temperature of the water.

Electric Towing.

Of the 120 papers which were read at the tenth International Congress of Navigation, held at Milan, Italy, in September, one of the most interesting was that of Mr. Leon Gerard and Mr. St. Johns Clarke, which dealt with electric haulage on canals. The paper described the experimental work which has been done on the Erie

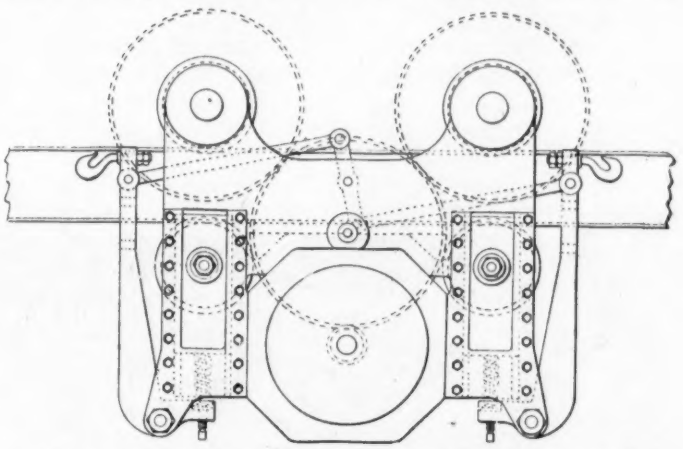


FIG. 1.—ELEVATION OF "PROPORTIONAL ADHERENCE TRACTOR."

Canal. A description of the early experiments with electric towing near Schenectady, N. Y., was given in these columns November 14, 1903.

In the earlier experiments it was found that the weight of the electric tractor could not economically be made great enough to afford sufficient tractive force to give the proper speed to the barges. An improvement was found in the use of powerful springs, which were caused to give a gripping effect on the under rail. A difficulty encountered with this method resided in the low efficiency with high traction strains, which would fall to 45 per cent with strains of 220 pounds.

Within the past year there has been employed on a special track at Schenectady a new type of tractor called a "proportional ad-

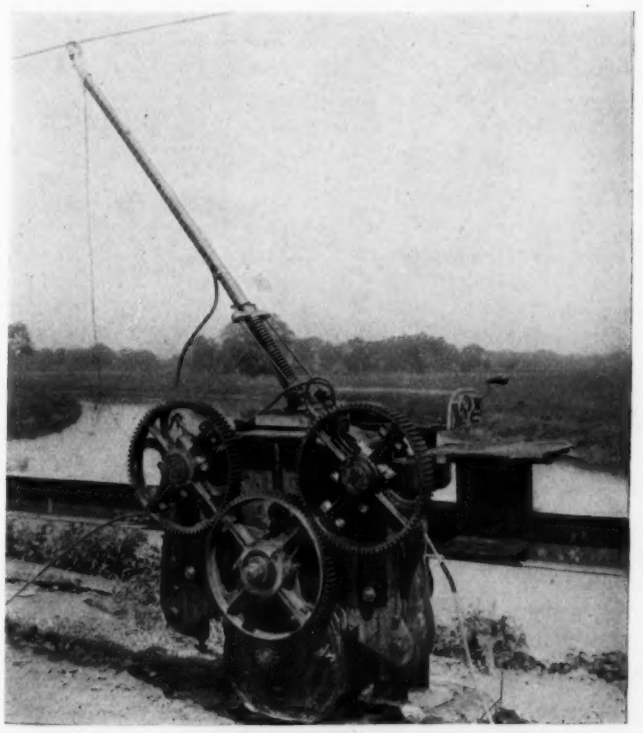


FIG. 2.—IMPROVED TOWING DEVICE WITH GEAR COVER REMOVED.

herence tractor," which is represented in Fig. 1. The driving wheels, which are 12 in. in diameter, work on the top part of the guide girder. The main portion of the tractive effort at the moment of starting is supplied by wheels which run under the guide girder. These wheels are accurately fitted into place. The pressure exerted by them comes into play only when the traction strain is applied by the tow rope. The two springs, seen under the pressing wheels

in Fig. 1, are so adjusted as to obtain a contact with the guide girder without undue pressure.

A view of the completed contractor with gear cover removed is shown in Fig. 2. Although this apparatus weighs only three tons, it is capable of exerting a pull of one ton at a speed of 4½ miles per hour, under which condition the overall efficiency is 86 per cent. The tractor is equipped with a 45-hp motor of the mine type, and forms a compact iron clad and enclosed construction, the center of gravity of which rests under the guide girder.

The track consists of girders held in place by vertical posts of lattice construction to which they are fastened through brackets,

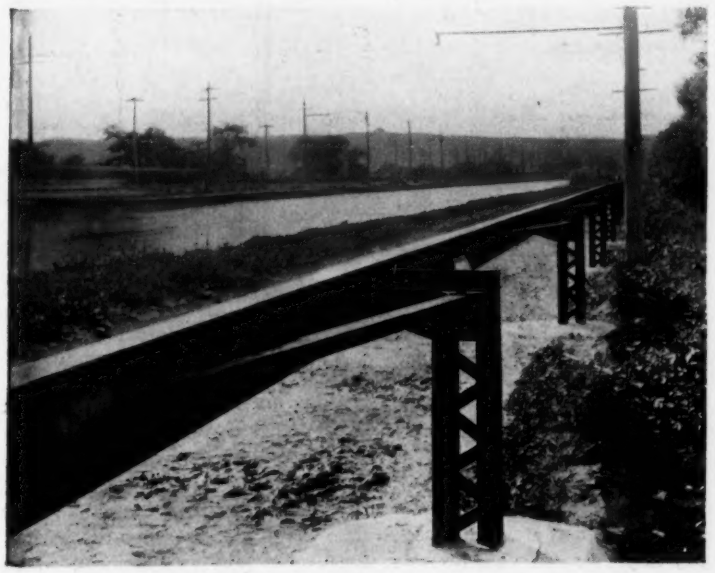


FIG. 3.—TRACK OF IMPROVED TOWING DEVICE.

as shown in Fig. 3. A single track weighs 60 tons per kilometer, and a double track weighs 105 tons per kilometer. The track proper is formed of 10-in. girders with large flanges, and weighs 80 pounds per yard. It presents a projecting guide on the top and bottom flanges. A track of this construction lends itself most favorably to electric traction for canals, the haulage path of which is narrow, and it is well adapted to overcoming the difficulties due to crossings and bridges, and those found in tunnels of reduced sections.

With no load and at the greatest speed the apparatus does not exert on the track any pressure other than that due to its weight

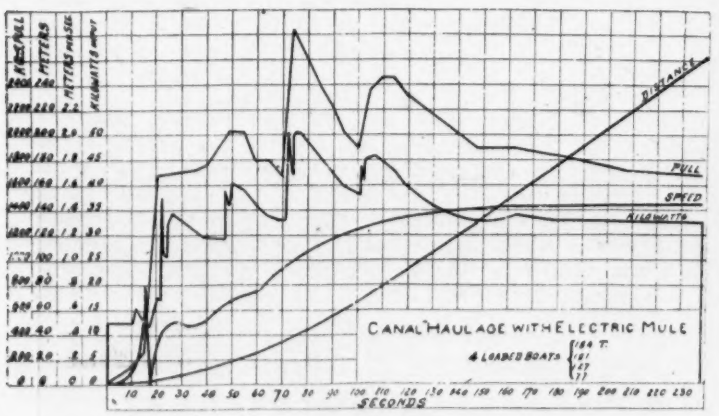


FIG. 4.—STARTING DIAGRAM WITH FOUR BARGES.

of 64,000 pounds. At a speed of 8 miles per hour without load the tractor motor absorbs 7 kw.

Fig. 4 shows the performance of the tractor when hauling four barges weighing complete 839 tons, of which 579 tons represent useful weight. The six peaks on the kilowatts input curve indicate the corresponding number of points on the controller. At the 70th second the pull at the hook reached 6,300 pounds, and it decreased to the normal running value of 3,800 pounds in about 200 seconds, when the speed reaches 3 miles per hour. It is estimated that the net efficiency is 84.5 per cent. It is believed that the "proportional adherence tractor" can improve the efficiency of electric canal haulage, increase its speed and render it thoroughly practicable.

New York City Destructor Plant for Lighting.

An interesting municipal plant in which the electric power derived is looked upon as a welcome by-product is found in the incinerator recently erected at Tompkins and Delancey Streets, in New York by the Street Cleaning Department for the purpose of destroying the combustible part of the city's rubbish and supplying illumination to the Williamsburg Bridge, which it adjoins.

Only a selected portion of the material collected by the street cleaners is brought to the incinerator, all vegetable matter and ashes being otherwise disposed of. The major part of the seven cubic

FIG. 1.—VIEW OF REFUSE CONVEYOR, SHOWING FUEL.

yards, which form a department load, consists of wood from old furniture, boxes and barrels and paper and rags from all sources. Each load is carefully picked over by parties who pay for the privilege of obtaining the rags and similar material, so that the remaining rubbish consists largely of paper and wood. Previous to the construction of the present plant and a smaller incinerator on Forty-seventh Street, this material had been disposed of by dumping it into the sea or placing it as filler on low land. It is estimated that the

FIG. 2.—VIEW SHOWING METHOD OF FEEDING FURNACE AND FUEL USED.

disposal in this manner has cost 30 cents per cubic yard, and that the incinerator, treated simply as a means of destroying the rubbish will effect a saving of $10,000 per year.

The feature of particular interest in connection with this novel plant resides naturally in the construction and operation of the furnace, and in the means employed in handling the unusual fuel. Fig. 1 shows the fuel conveyor which serves to elevate the rubbish from the dumping place of the street cleaners to the stoke holes of the furnaces. The conveyor consists of an engine-driven linked iron belt which allows the rags, paper and wood in all forms to be passed slowly in front of a gang of pickers who remove all rags and similar refuse. The remaining material, largely of a com-

bustible nature, then passes to a small sorting space where the non-combustible matter such as cans, bottles, wire springs, etc., is removed. The final sorting space is immediately adjacent to the furnace doors through which the combustible material is passed at a regular rate, independent of the demands for steam by the electric lighting plant.

The method of feeding the furnaces is indicated in Fig. 2. There are two furnaces, each of which is equipped with top, side and end doors. One of the furnaces is constructed with a single combustion chamber and an ash pit, while the other, which was designed by Mr. Fred L. Stearns, of the Street Cleaning Department, is of the two-story type, being supplied with two sets of grates, one above the other, and a lower ash pit, as shown in Fig. 5. The lower set of grates has been installed so as to obtain, as nearly as may be, the full heating value of the fuel before it passes to the ash pit, and to

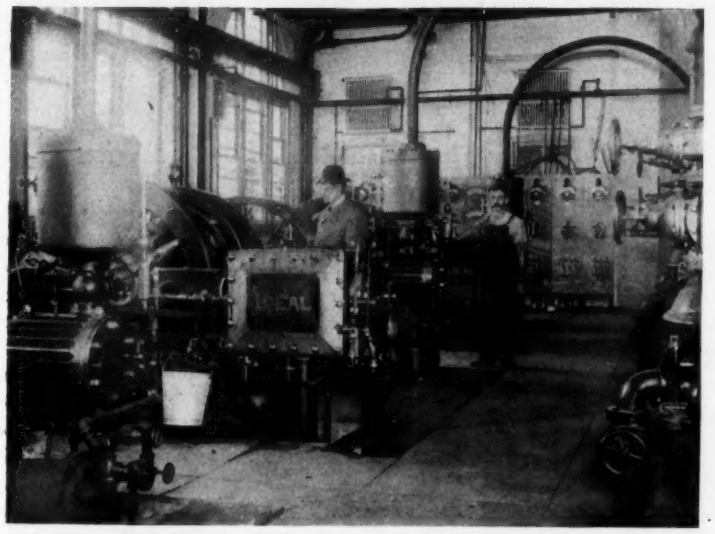


FIG. 3.—INTERIOR OF DYNAMO ROOM.

overcome the difficulty of making a single set of grate bars of a compromise size to serve for the heterogeneous mass of fuel. The side doors have been provided for the purpose of removing any non-combustible material that might pass unnoticed into the furnace through the top doors. Bulky rubbish, such as furniture, etc., is fed through the end doors.

Each furnace is operated entirely distinct from the other, although the gases from the two pass finally to the same chimney, a 200-ft. brick stack, the top of which rises 75 ft. above the bridge, and carries the smoke to a height sufficient to eliminate any objectionable odor. A separate boiler is provided for each furnace, and between each boiler and the corresponding furnace there is placed a set of dampers which are so arranged that the gases may either pass under the boiler and then to the stack or may go directly to the stack. An idea of the temperature which the fuel affords may be gained from the fact that a cast-iron damper 3½ in. thick was melted out after a service of one week. Fire brick has been substituted for cast iron as a material for the dampers, and no additional trouble is expected from this source.

It may be of interest in this connection to note the results of tests made at the Forty-seventh Street incinerator upon a lot of rubbish similar to that used at the Williamsburg Bridge plant, tests at the latter place not having as yet been made. During a certain run of ten hours, during which a total weight of 102,531 pounds of rubbish was used, the average horse-power observed was 232.7. An analysis of the rubbish used showed that 43.8 per cent was combustible matter, 7.4 per cent was ash, and that 48.8 per cent was taken by the rag pickers or discarded as non-combustible. It is worthy of note that the ashes are disposed of to the American Tobacco Company for use upon its lands.

Under each boiler, entirely distinct from the main incinerator furnace, is placed an auxiliary furnace in which may be burned bulky furniture and other wood fuel, or coal may be used if emergency should require. Thus when the proper dampers are closed the boilers may be fired in the ordinary manner. The room in which the incinerator and the boiler plant are placed is entirely separated from the engine and dynamo room. The former room is devoted exclusively to the destruction of rubbish and the production of steam, and is in charge of the Street Cleaning Department. In the latter room are placed all of the apparatus for using the steam, and the steam auxiliaries, and this room is in charge of the Department of Bridges.

A view of the engine and dynamo room is given in Fig. 3. The electrical generating equipment consists of one 50-kw and two 100-kw Burke generators direct-connected to Ideal engines of the cross-compound type. The two larger engines have 12-in. strokes, with 20-in. and 12-in. cylinders, and are designed for a speed of 250 r.p.m. The small engine operates at 300 r.p.m., and is equipped with 16 by 9-in. and 9 by 9-in. cylinders. Each engine is connected to the armature of the corresponding generator through flange couplings which are keyed on to the respective shafts. The engines are operated condensing, each engine being provided with a Blake jet condenser. An enlarged section of pipe between the high-pressure and low-pressure cylinders of each engine serves as an intermediate receiver. Each receiver is supplied with a pressure gauge graduated from —30 pounds to +50 pounds, while a vacuum gauge graduated from 0 to —30 pounds is provided for each condenser. By means of these six gauges and an initial recording pressure gauge, the engineer in charge is enabled to judge of the performance of each engine. In the engine room are located a Blake 7½ by 5 by 6-in. feed-water pump and a 400-hp Cochrane feed-water heater of the open type. The supervision of these auxiliaries being exclusively under the control of the electric power department, the incinerator department is relieved of all responsibility with reference to the steam equipment, with the exception of that due to the single task of maintaining the desired steam pressure of 125 pounds.

The generators are of the direct-current type and are designed to operate directly on a three-wire system at 2 × 115 volts. The method of obtaining a neutral lead immediately from the machine itself is the feature providing most interest in connection with this type of generator. A so-called choke coil, an auto-transformer, is connected between certain points on the armature windings separated by 180 electrical degrees. It is evident that the central point of this coil will remain at all times at a potential midway between that at the two terminal points, and hence it will retain a mean potential between the positive and negative terminals of the machine. The choke coil is mounted directly on the revolving armature, while

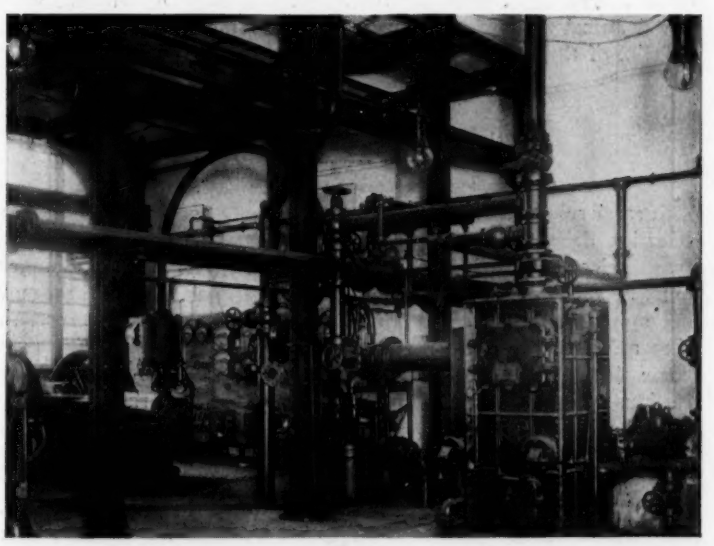


FIG. 4.—VIEW OF SWITCHBOARD AND STEAM AUXILIARIES.

the connection to the central point is made to a slip ring, so that for the positive, negative and neutral leads for the three-wire system there are required only the ordinary direct-current commutator and a single additional slip ring. The seeming simplicity of this device for three-wire operation is slightly modified by the additional requirements imposed by the equalizer circuits which are necessary when compound-wound generators are to be operated in parallel. In order that the machine may maintain the proper voltage with unbalanced loads on the three-wire circuits, it is necessary that the series coils be connected in both the positive and the negative circuits. For this reason one-half of the series field turns is joined in circuit with the negative lead and the other half is connected with the positive lead. For the purpose of allowing the several sections of the series coils of the individual generators to be properly joined in parallel, it has been found necessary to connect five main cables from each generator to the switchboard.

The switchboard, which is indicated in Figs. 3 and 4, consists of three generator panels, one totalizing panel and four feeder panels. Each generator panel is equipped with a four-pole knife switch, provided with four "Noarc" fuses, a field rheostat and two Weston ammeters. The totalizing panel carries a 300-volt Weston voltmeter, a 1,500-amp. Weston ammeter, a Thompson three-wire watt-hour meter and a single-pole knife switch for the neutral wire. Each feeder panel is provided with a Weston ammeter, an "ITE" double-pole circuit-breaker and a three-pole knife switch. Three of the feeder panels serve for supplying power to the lamps on the Williamsburg Bridge, which are placed on three circuits, designated as the Brooklyn end, the south side and the north side, respectively. The fourth panel is used at present for the lamps around the incinerator and the generating plant. It is expected that the plant will later supply power for lighting several school houses in the neighborhood.

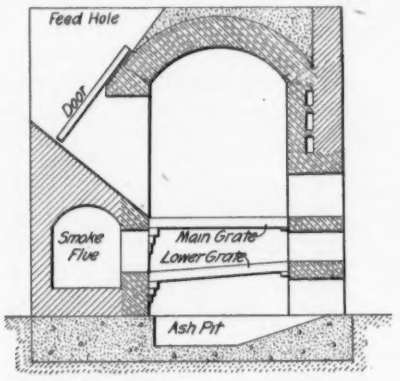


FIG. 5.—CROSS-SECTION OF TWO-STORY FURNACE.

This plant was designed by Mr. H. de B. Parsons, consulting engineer for the Street Cleaning and Bridge Departments of the City of New York. It was constructed by the Ralph J. F. Gerstle Company, at a cost of $34,000 for the incinerator and $49,400 for the boilers and electrical generating plant. The incinerator is operated by Mr. Fred L. Stearns, for the Street Cleaning Department, while the electrical generating equipment is under the charge of Mr. K. L. Martin, of the Department of Bridges.

New Telephone Patents.

ADJUSTABLE HARMONIC SELECTIVE SYSTEM.

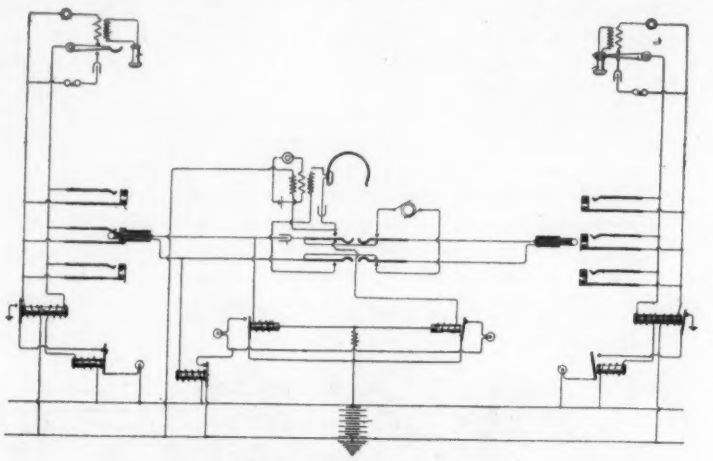
Several selective ringing systems have been produced wherein the selection depends upon the use of alternating currents of different frequencies for the different stations. With such systems the ringers must be designed so that the natural period of vibration of its moving system approaches that of the ringing current. Therefore, the ringer for each frequency of current must be distinctive. To overcome this necessity of using as many kinds of ringer as there are stations on a line, Mr. E. A. Reynolds, of New York City, has invented a ringer which is so adjustable that it may be made to respond to any desired frequency. The clapper rod is flexible for a short distance near its point of attachment to the armature. Its rigid portion is clasped between a pair of rigid guides. These guides may be placed near the flexible portion or near the hammer or at any intermediate point, the guides always acting as a pivot.

DESK STAND SET.

Mr. W. Kaisling has patented an improved desk stand set in which none of the exposed parts are included in the electrical circuit, and therefore all chance of shock is precluded. The hook switch springs are within the tubular stem and the switch lever actuates them through the agency of a hard rubber plunger. The transmitter is provided with two insulated terminals, and two insulated conductors pass through apertures in the hinged joint at the lug and are entirely concealed. The Stromberg-Carlson Company has been assigned the patent for this apparatus.

SWITCHBOARD CIRCUIT SYSTEM.

The cut shows a circuit system for a switchboard, worked out upon the two-wire plan. The key to the situation is the cut-off relay, which is permanently connected to the line, and which is differentially connected. When no plug is in a jack the line relay current, of course, passes through both coils of the cut-off relay and thus it is not affected. As soon as the shunting effects of the cord circuit are introduced at the jack, the cut-off relay operates. This circuit is the



WEBSTER EXCHANGE SYSTEM.

invention of H. G. Webster, who has assigned his patent to the Stromberg-Carlson Company.

APPARATUS FOR THE DEAF.

The telephone is now considerably used as an apparatus to assist the deaf in hearing. Of course, for such service the parts must be of special design. The transmitter must pick up all sorts of extraneous sounds in its neighborhood, and with the receiver must greatly augment these.

Mr. H. G. Pope, of New York City, has recently patented a special form of head receiver adapted to this service. The magnet is of the iron clad tubular sort, and is adjustable with reference to the diaphragm. The ear piece is also special, being serated radially.

Mr. Pope has also patented a loud speaker which is virtually the same sort of receiver provided with a self-adjusting stand and a trumpet mouthpiece.

LOCK FOR AUTOMATIC SWITCHES.

With automatic exchange systems a fire alarm or other special feature may be provided, which when used legitimately is of considerable service. On the other hand the ability of any one to send in a false alarm and cover his tracks by immediately restoring his switch to normal is objectionable. In order to prevent this, J. Erickson, of Chicago, has invented a locking device which so locks a switch calling an alarm number that it cannot be restored until opportunity is given to note the number.

LETTER TO THE EDITORS.

Measuring the Power of Induction Motors.

To the Editors of Electrical World and Engineer:

SIRS:—Many articles on the slip method of measuring output of induction motors have come to my notice. In nearly all of these, the synchronous revolutions are determined by means of a frequency indicator or by going back to the generator speed in some more or less complicated fashion. In no case has there been given the simple and obvious method outlined below.

The instruments required are the apparatus by means of which to observe the slip, say a stroboscopic disc, and a simple revolution or so-called speed counter. If the voltage at the motor terminals is different from that at which the motor is rated, a voltmeter is necessary in addition to the above, because the slip which is given by the manufacturer refers to the motor with the rated voltage applied to its terminals. In case of variations in voltage the usual correction must be applied.

A convenient number of apparent revolutions of the disc is counted, and during this time the total revolutions of the motor are determined by the revolution counter. Obviously then, the revolutions slipped plus the revolutions of the motor equal the synchronous revolutions in the observed period. For example, a disc was observed to make 10 apparent revolutions. During the same time the revolution counter showed that the motor made 265 revolutions. The synchronous revolutions then were

275. The full-load slip of the motor as given by the manufacturer, when corrected for the voltage at the motor terminals at the time of the test, was 3.97 per cent. If the motor had been under full load, it would have slipped .0397 × 275 revolutions, or 10.92 revolutions. It was running, therefore, at 91.6 per cent of full load, assuming that the slip is directly proportional to the load.

The chief advantages of the method are that it is not necessary to estimate fractions of revolutions of the disc; it is independent of variations in generator speed, and it averages the fluctuations in load during the test period, precisely as does any other integration measuring process.

SAN FRANCISCO, CAL. ALLEN H. BABCOCK.

DIGEST OF CURRENT ELECTRICAL LITERATURE

DYNAMOS, MOTORS AND TRANSFORMERS.

Induction Motors.—CHURTON.—A paper read before the Leeds Section of the British Institution of Electrical Engineers. The author compares the performance and characteristics of motors of the induction type when provided with short-circuited, and with wound rotors, respectively, and outlines their performance on single-phase and polyphase circuits. The curves shown in Fig. 1 are from tests taken upon two motors, one having a short-circuited rotor and the other a wound rotor, but in other respects identical machines. It will be noticed that both the efficiency and power factor are higher in the case of the machine with the short-circuited rotor. Each machine was constructed to give 5 hp at about 1,420 revolutions on single-phase, 200-volt, 50-cycle circuit. For the purpose of speed regulation the wound rotor motor is the more satisfactory, though for some purposes, such as operating cranes, the short-circuited rotor with conductors of relatively high resistance combined with graduated transformers for varying the voltages on the stator windings, is sometimes preferred for polyphase motors. The performance of motors with regard to starting torque and current on single and

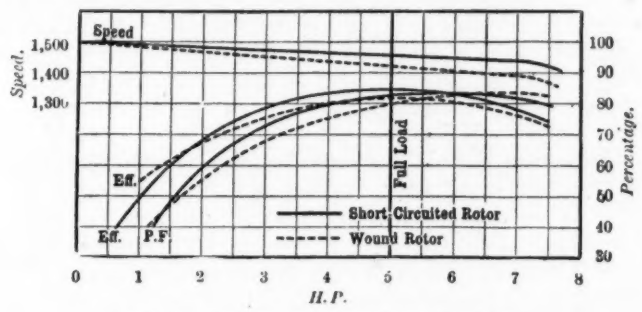


FIG. 1.—CURVES OF INDUCTION MOTORS.

two-phase circuits of 50 cycles, 200 volts and with short-circuited and wound rotors, respectively, is given as follows, the figures referring to the normal full-load values:

	Single Phase.		Polyphase.	
	Starting current.	Starting torque.	Starting current.	Starting torque.
Short-circuited rotor	1.25	0.45	1.25	0.75
Wound rotor	1.0	0.75	1.0	1.0

The superiority of the polyphase motor is clearly shown. There are several means by which the starting torque of the single-phase motor may be somewhat improved, but which involve lower efficiency under load. The author finally discusses the influence of frequency. High frequency is not only prejudicial to efficiency, power factor and torque, but is particularly detrimental to good starting performance. High frequency to the motor use implies higher cost of motors and higher cost of working, and to the electricity supply undertaking it means lower day load (because of the less inducements to power users to adopt the supply), and greater proportional loss on mains on account of the lower power factor of the motors. The author suggests that a frequency of 50 cycles should be adopted whenever possible.—Lond. *Elec.*, October 27.

Armature.—In notes on the recent Olympia Electrical Exposition in London a motor armature of a new pattern, made by Vickers Sons & Maxim, is described. The motor exhibited is rated at 150 hp and was built to the order of the Admiralty. Its special feature is that the core body is not keyed to the shaft in the ordinary manner. As shown in Fig. 2 a considerable portion of the shaft is of triangular section, the altitude of the equilateral triangle being greatly in excess of the diameter of the shaft proper. It should be understood that the entire shaft consists of a single forging. Each apex of the triangle is rounded off and forms a key which fits into a groove cut in the stampings. Thus the moment of the couple tending to shear the key, when the motor has to start against a heavy load, is considerably less than when the keyway is cut in the surface of an ordinary circular shaft. For this reason the motor is peculiarly suitable for driving rolling mills and other purposes

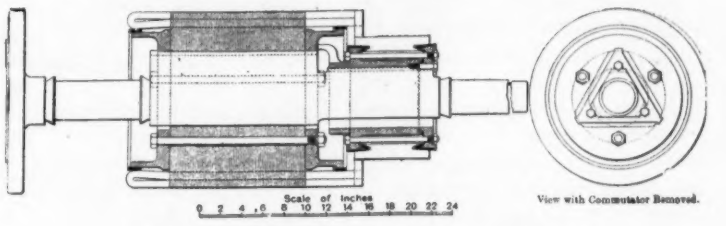


FIG. 2.—SECTIONAL VIEWS OF ARMATURE.

where a large starting torque is met with.—Lond. *Elec.*, October 27.

Double-Field Alternators.—A fully illustrated French translation of the recent German article by Ziehl on "double-field alternators" for single-phase and polyphase currents, which was abstracted in the Digest some time ago.—*L'Industrie Elec.*, October 10.

Alternators.—RUSHMORE.—An illustrated paper describing the origin, development and present status of alternating-current generators.—*Jour. Franklin Inst.*, October.

LIGHTS AND LIGHTING.

Street Lighting in London.—An account of photometric tests made by Bailey on old and new street lamps in the City of London. From these tests he deduces the following comparative figures, the cost of gas lighting being taken from the *Journal of Gas Lighting:*

	Average total cost per cp. per annum.
Gas.—Double burner, ordinary low pressure incandescent (mean of six tests)	22.2 cts.
Single burner, high-pressure gas.....	1.8
Double burner, high-pressure gas.....	23.4
Arc Lamp.—Old lantern	16.
Flame arc	10.

It must be noted, however, that whereas the cost of the electric arc is quoted, including all charges of maintenance and interest and redemption of capital, in the case of the gas lamp the cost is solely for maintenance charges; that is to say, the supply of gas and mantles only, and it does not include any portion of the capital cost of providing posts, mains or fittings; and further, the hours per year for the use of electric arcs are fixed at 4,473, but the hours of burning adopted for the gas lighting "have been observed to be less." The tests were made on a clear night under normal conditions. "The candle-power measurements were in each case taken at a horizontal distance from the light equal to twice the height from the ground level, thus enabling positions to be taken, whereby the lamp measured was the only light in line with the photometer screen." From these tests of candle-power Bailey estimates the illumination at a distance of 100 ft. from the source as follows:

	Candle-feet.	Ratio.
Double ordinary incandescent gas-lamp illumination.....	0.013	= 1.0
Single high-pressure incandescent gas-lamp illumination.....	0.016	= 1.24
Double high-pressure incandescent gas-lamp illumination.....	0.027	= 2.10
Ordinary arc lamp	0.060	= 4.50
Flame arc lamp	0.120	= 9.0

Some criticisms are added of statements of the gas people.—Lond. *Elec.*, October 27.

Arc Lamps.—In notes on the recent Olympia Exposition in London, the Regina and Reginula arc lamps are referred to. In the Regina arc lamp both the arc and regulation gear are enclosed in one air-tight space. A syphon and safety valve are put in action should the pressure on the globe become too high. A length of 1½ in. to 1⅓ in. of the carbons glow with a white light. One consequence of the air-tight arrangement is the long life of carbons, which

is claimed to be between 300 and 400 hours. After that time it is necessary to replace only the upper carbon, as the remaining part of the upper carbon is used as the lower carbon. The overall length of the lamp is 2 ft. 2 in., its weight, complete, being 19 pounds. The inner globe is protected by a wire net and this arrangement makes a dirt-catching wire net on the outer globe unnecessary. The carbon-catch consists of two cheeks, which pinch the carbon, lifting it up when the magnet is lifted by the coil, an arc between the carbons resulting thereby. These two cheeks are fixed to a hollow plunger, which is sucked up or let down in the regulating solenoid. The carbon slides in the hollow plunger. When the carbon is so far consumed that the cheeks touch a ring, it is released and drops down easily. The resistance in the arc diminishes, the magnetic field grows stronger and the carbon is again lifted by the magnet. If there is no current on the mains, the top carbon rests on the lower carbon. The Regina lamp is made for voltages and currents ranging from 100 to 250 volts and 2.5 to 8 amp., respectively, the available pressure across the arc being, it is stated, from 68 to 72 per cent. When used for alternating current a choking coil (with $\cos \phi = 0.9$) is used. Alternating-current lamps are made for 40 to 60 periods per second and for voltages between 110 and 220 volts, the voltage across the arc being as high as 85 to 90 per cent. The continuous-current type will burn in series of two, three, four or five lamps. It is claimed that the light given off by a 200-volt lamp is quite white with no bluish tints. The Reginula lamps are similar in construction to the Regina lamps, but are smaller in size and designed for currents from 1 amp. upwards and for 110 to 220 volts. It is stated that a Reginula lamp with 5-mm. carbons will burn for 40 hours when fed with continuous current, and from 15 to 20 hours when supplied with alternating current.—Lond. *Elec.*, October 27.

Window Lighting.—ROBERTS.—A short article on the advantages accruing to central stations by the addition of window-lighting loads which come on after business hours. The author points out the need of co-operation between the central station manager and the customer in order to obtain the best results. The advantages of the various types of lamps for window illuminating purposes are given.—*Am. Elec.*, November.

POWER.

Electricity in Mines.—RAVENSHAW.—The first of a series of Cantor lectures on the use of electricity in mines. The following table shows the various classes of machinery that are in general use, with the type of load and the range of sizes that are usually met with:

	Usual sizes hp.	Type of load.
Winding	50 to 2,000	Intermittent with frequent short stops.
Single rope haulage	5 to 200	Intermittent with long stops,
Continuous haulage	15 to 500	Steady load.
Main and tail haulage	15 to 100	Intermittent with fairly long stops.
Locomotives	15 to 100	Intermittent with variable stops.
Creepers	10 to 30	Continuous variable load.
Coal cutters	20 to 50	
Pumping	5 to 500	Steady load.
Air compressors	20 to 100	Intermittent.
Fans	20 to 200	Steady.
Screens	20 to 50	Steady load.
Coal washing	20 to 100	Fairly steady.
Stamps	15 to 100	Steady.
Crushers	20 to 100	Very variable.

The author first discusses winding and says that steam engines are at present almost universally used for winding, many of them being of large size and capable of raising heavy loads at a high speed. Since the load fluctuates enormously, the application of electric driving without the result of sudden fluctuations on the supply network necessitate some method for storing up energy during the period of no load. For small plants it is probable that a motor having the speed regulated between, say, a third and full speed by means of shunt resistance, would give a simple solution, in conjunction with a motor carrying a heavy fly-wheel running free and connected across the mains. For large plants a more elaborate system has in some cases been adopted. The author refers to the well-known Ilgner system which has been repeatedly described in the Digest. He then discusses underground haulage. He says that electric locomotives are very little used in England, while they are much used in the United States, where the underground roads are more level. With respect to pumping he says that electric driving is particularly applicable to centrifugal pumps. He then refers to coal-cutting and the equipment of the generating station. He remarks that in many cases a remarkably low cost per kw-hour generated is obtained when there is a steady load extending over long hours. Owing to the fact that comparatively large powers are required at a considerable distance from the source of supply, and that in fiery mines a pressure of more than 500 volts is not allowable, the conductors must be of large section, and in many cases, in order to avoid an excessive drop of pressure, the density does not exceed 300 to 400 amp. per square inch.—Lond. *Elec.*, October 27.

Tar Burning in Gas and Electric Plants.—FIELD.—A paper on the use of tar as fuel in gas and electric plants. The author describes suitable tar strainers and tar burners and gives some results from actual practice. "Tar used weighed 9¼ pounds per gallon, and the average evaporation was 12.82 pounds of water per pound of tar. This low value was due largely to an unfavorable load factor during several hours of the day, as full-load tests indicated an evaporation of nearly 14 pounds of water per pound of tar. The tar is pumped without any strainers whatever, direct from the tar well to the burners by a small Marsh steam pump working under a pressure of from 125 to 170 pounds per inch. The tar pressure must be higher than the steam pressure used, and in our case this varies from 100 pounds during light loads to 150 pounds at the peak. The flame is directed downward by bending the nozzle so that it will strike the grate bars about 3½ ft. back from the furnace doors, where it is received on a bed of about 8 in. of ash, clinker, coal or breeze. The ash-pit doors are left open and ash-pits are filled with water to prevent warping the grates, but as there is very little draft through the mass of material on the grates the principal air supply is an over draft admitted through shutters in the firing doors. The burners rarely clog, and they require a minimum of attention. The flame is a single whirl of intense white, and there is no smoke. The entire installation can be made for $5 per boiler, exclusive of pump, which in our case cost about $31, and is large enough to supply two boilers to their greatest capacity. In figuring the fuel value of tar against any fixed price per gallon, it must be remembered that the price received is never net, since an allowance must be made to cover pumping, barreling and carting the product. In burning tar these costs, with the possible exception of the pumping, can be entirely eliminated and even the pumping may be done away with in firing benches, as the tar can readily be taken direct from the hydraulic main to the burner by the installation of a simple tank separator provided with suitable overflow connected back into the main leading to the tar well." In the discussion various speakers described their experience with tar burning.—*Progressive Age*, November 1.

Water Turbine Plants.—BAASHUUS.—An article giving advice to electrical engineers concerning the making of a first approximate calculation of a water turbine plant. The author is engineer of Escher, Wyss & Co. He points out that such approximate calculations can easily be made and do not require consultation with turbine specialists. When one has the data on the quantity of water to be utilized and the available fall, the next questions are what type of turbine to choose, their efficiency and their number of revolutions and especially the space required by them and by the building. When these questions are answered properly one has an approximate first basis for economical calculations so that it is not necessary to consult the turbine engineer. The author gives formulas for answering these questions on the basis of actual experience.—*Elek. Zeit.*, October 19.

Water Power Plant in the West.—ALLEN.—An illustrated description of the Washoe Power & Development Company's plant on the Truckee River. The plant contains two main generating sets each of 750 kw. These are three-phase generators of the revolving-field type, the voltage generated being 2,300. For transmission the voltage is raised to 20,000. There are two sub-stations at Sparks and Reno where the voltage is reduced to 2,500 for distribution.—*Jour. of Electricity*, November.

Niagara Falls.—The first part of a long illustrated description of the Niagara power plant of the Electrical Development Company of Ontario.—*Engineering News*, November 9.

Electric Driving of Rolling Mills.—BAYER.—A mathematical paper discussing the case in which a three-phase motor with fly-wheel is used for driving a rolling mill and receives the current directly from the central station.—*Zeit. f. Berg. u Hüttenwesen*, September 23.

Elevator.—CHIGNATERIE.—An illustrated description of the electric lift to the top of the Burgenstock mountain in Switzerland.—*Le Genie Civil*, October 21.

Corrosion of Condenser Tubes.—SEXTON.—An illustrated article discussing the reasons for the corrosion of condenser tubes, and means for preventing it.—*Eng'ing Mag.*, November.

TRACTION.

Three-Wire System for Traction.—An illustrated description of the electric road between Tabor and Bechyne installed by the firm of Krizik. The length is 15 miles. The three-wire direct-current system is used with the rails as neutral conductor. The total voltage is 1,400; that is, 700 volts between each overhead conductor and the rails. The power house contains two railway generators, each of 80 kw and 2x700 volts. The motor cars have four axles and contain four motors, each of 30 hp at 650 volts, 40 amperes, the number of revolutions being 550. The ratio of gearing is 15 to 75. At starting all motors are connected in series, then they are connected in groups of two in parallel. The connections for running

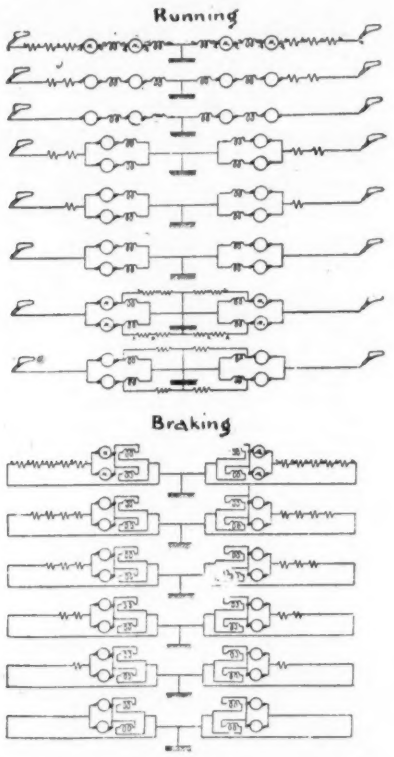


FIG. 3.—DIAGRAM OF CONNECTIONS.

and breaking are shown is Fig. 3. The controller has three steps with the motors in series and three steps with groups of two motors in parallel. For increasing the speed there are provided two further steps with resistances in parallel with the field windings. In the field coils the current always has the same direction. For the regulation of speed and for breaking, the connections of the exciting windings are changed. There are six steps for short-circuit breaking. The fundamental idea of the installation is said to have been to make the first cost as low as possible and to use in operation as small trains as possible..—*Elek. Bahnen,* October 4, 14, 24.

Proposed Regenerative Control in the New York Subway.—Some editorial notes with respect to the suggestion of Dr. Soper that instead of stopping the trains with the present brakes, the motors might be used as generators to restore current to the line, thus reducing the draft on the power station and the consequent amount of heat liberated in the subway. It is thought that practically nothing is to be hoped for in this direction for sanitary improvement of the Subway atmosphere. Two objections are raised against the regenerative system of controlling the speed of electric trains. The first is the heating effect on the motors when used as generators, and it is said that larger and heavier motors would be required. As a second reason against any and all forms of electric braking is quoted the matter of safety.—*Eng'ing News,* November 9.

Electric Railway Signals.—An illustrated article on electric signaling on the Great Northern & City Railway. This railway uses two conductor rails, the running rails not being employed for conveying traction current. The track rails are, therefore, now employed for signaling purposes. The general idea of the signaling system is to actuate the signal lamps by the train itself in such a manner that the signals, which consist of electric lamps in the tunnels and semaphores in the open, are constantly set at "danger" behind a train but cleared again after the train has proceeded a certain distance beyond. Signals in the previous sections cannot be cleared until the signal immediately behind the train has gone to danger.—Lond. *Elec.,* October 27.

INSTALLATIONS. SYSTEMS AND APPLIANCES.

Reverse Power Relay.—In a very fully illustrated article on new Ferranti switch gear exhibited at the Olympia exposition in London a reverse power relay is described. It depends mainly of the movement of a Ferranti alternating-current meter placed on end, and it is arranged so that with power flowing in the right direction in the controlled circuit the rotating part of the relay impinges against one side of a pivoted weight. With power flowing in the right direction, the movable disc of the relay is stopped from rotating and presses against that side of the pivoted weight which prevents it falling over. It is thus seen that it is impossible for external vibration to cause the pivoted weight to fall over and complete the tripping circuit. On a reversal of power in the main circuit, to a predetermined extent (controlled by the hanging weight), the disc will begin to move in the opposite direction to that in which it is urged by a normal flow of power. Just before the disc has made one complete revolution, it impinges, with a smart knock, on the other side of the pivoted weight, throwing it over, and thus causing the main circuit-breaker to be automatically opened. The speed at which the disc makes this one revolution is determined, firstly, by the extent of the reversal of power, and, secondly, by the retarding action of a permanent magnet between the poles of which it travels. The longest time taken by the relay to close the tripping contactor after the occurrence of the reverse current is generally about 20 seconds, when the reverse power just exceeds that for which the relay is set.—Lond. *Elec.,* October 20.

Electrical Equipment of Railway Shop.—An illustrated article describing the Keyser Valley shops of the Lackawanna Railroad. Electricity for power and light is supplied by one 100-kw and two 300-kw three-phase, 60-cycle, 480-volt generators. Power is transmitted from the power house to the various shops by lead-covered cables which are placed in underground terra-cotta ducts. The various motor drives installed at the shops are tabulated. Four hundred and forty-volt induction motors are used exclusively. With one exception, the individual drives are all belt-connected, and the group drives are similarly connected. There are over two hundred arc lamps used for indoor lighting, and these are all fitted with concentric diffusers. Series arc lamps are used for all-night lighting of the buildings and grounds. The distribution of arc and incandescent lamps is said to make the Keyser Valley shops one of the best-lighted railroad repair shops in the country.—*Am. Elec.,* November.

Hamburg.—RUPPRECHT.—A well illustrated paper on the electric distribution network of Hamburg. There are four central stations and eight sub-stations, furnishing direct current for tramways and lighting. Three-phase currents are used for transmission between certain stations and sub-stations.—*Zeit. d. Ver. Deutsch Ing.,* August, September, October; abstracted with various illustrations in *Le Genie Civil,* October 21.

High-Tension Circuit-Breaking Devices.—FERNANDEZ.—An illustrated article containing some practical information on the operation of various types of high-tension circuit-breakers.—*Amer. Elec.,* November.

WIRES, WIRING AND CONDUITS.

The Most Favorable Conditions for the Transmission of Energy.—SARRAT.—A paper presented before the International Society of Electricians in Paris. The author criticises a former paper of Swingedauw and claims that it is incorrect to consider in a general way the current density which Swingedauw calls the most profitable one as analogous to that which results from the rule of Lord Kelvin and that under practical conditions the former quantity should be used only in exceptional cases. The paper is chiefly mathematical. *Bull. de la Soc. Internat. des Elec.,* July.

Reinforced Concrete Poles.—A short article on the use of reinforced concrete poles on some of the Canadian transmission lines. —*Amer. Elec.,* November.

ELECTROPHYSICS AND MAGNETISM.

Velocity of Roentgen Rays.—MARX.—An abstract of a paper read before the Society of German Naturalists and Physicians. To measure the speed of Roentgen rays, the author has used a method which enables one to measure directly periods of time, smaller than

the time in which light passes through a distance of 10 centimeters (that is, smaller than one-third of one-thousandth of one-millionth second). The radiation to be tested is produced periodically by short electric waves. In synchronism with the rays, an electrode oscillates in a special tube, so that this electrode is as many times per second positive and negative as the cathode of the Roentgen tube. If the Roentgen rays reach this electrode while it is negative, it sends out cathode rays; when it is positive, it does not do so. If the distance of the Roentgen tube is changed, it is possible to reach with short electric waves a certain point at which the Roentgen rays just reach the electrode in the positive state so that no cathode rays are emitted. If now a wire of 10 centimeter length is inserted into the wire leading to the electrode, cathode rays are again emitted, and a displacement of the tube is necessary to avoid again the emission of cathode rays from the electrode. Since this necessary displacement is found to be identical with the 10-centimer of inserted length of wire, the equality of the velocity of the Roentgen rays and of the velocity of light is proven. The author remarks that by means of a similar method the fundamental question as to the influence of the motion of the earth on the speed of light could be decided.—*Zeit. f. Elek* (Vienna), October 22.

ELECTROCHEMISTRY AND BATTERIES.

Electric Furnaces.—FITZGERALD.—A continuation of his illustrated serial on electric furnace construction. In the present installment the Ruthenburg and Acheson furnaces are discussed. The objection of the Ruthenburg furnace is to agglomerate finely divided magnetic iron ore by passing an electric current through it. The author shows that no great amount of power is required in order to reach the fusing temperature at the points of contact of the ore grains. The theory of the Acheson graphite process is that graphitization is brought about by the formation and subsequent decomposition of carbides, hence a carbonaceous material, such as anthracite coal, is chosen, because it contains a certain quantity of carbide-forming material distributed throughout it. On the other hand, when a very pure carbon, such as petroleum coke, is employed, the carbide-forming substance is mixed with the charge. Data are given on the construction of a furnace for making graphite from petroleum coke. The author then discusses the Acheson furnace for making graphite electrodes, detailed figures being given of the construction of such a furnace. The current passes alternately through sections of the furnace filled with granular carbon or electrodes, and as the resistivity of a mass of the granular carbon is very much greater than that of the electrode the chief generation of heat takes place in the former. Herein lies the chief feature of the invention, for by this ingenious arrangement the use of currents of very low voltage and enormous ampereage is avoided. For an actual furnace the author calculates the distribution of power in the granular carbon and in the electrodes as follows:

	Granular carbon. Kws.	Electrodes. Kws.
Initial	293.82	0.18
At end of five hours	750.05	5.95
Final	700.56	19.44

The article is illustrated.—*Electrochem. and Met. Ind.*, November.

Copper.—A discussion of copper smelting as a process for recovering gold and silver. Reference is made to the complex treatment of copper ores, consisting in furnace treatment to a 50 per cent matte, blowing this matte into blister copper, and finally electrolytic refining. In this last state the copper is turned out chemically pure and 98 to 99 per cent of actual values of gold and silver are recovered. With the great increase in the consumption of copper, due to general expansion in the electrical industries, the capacities of the electrolytic copper refineries near New York have greatly increased and are now about double what they were only six years ago. Some figures are given for the different refineries.—*Electrochem. and Met. Ind.*, November.

Analysis of Copper Slag.—SMITH.—The first part of a report on a co-operative analysis of copper slag. Samples were sent out by the author to a great many chemists and complete analyses were received from fifteen different parties with statements of the methods used, etc. These are critically discussed. In the present installment the determination of copper, silica and alumina is dealt with.—*Electrochem. and Met. Ind.*, November.

Rotating Cathode.—FLORA.—An account of experiments on the use of the rotating cathode for the estimation of cadmium taken as the chloride.—*Am. Jour of Science*, November.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Metcrs.—An official paper of the German Reichsanstalt describing some new types of meters of Aron for direct-current, single-phase and polyphase currents. The special details in which the new types differ from the well-known older type of Aron meters and which comprise an auxiliary coil and auxiliary springs are described and illustrated.—*Elek. Zeit.*, October 19.

Meters.—GERHARDI.—A continuation of his long illustrated serial. In the present installment he describes stands for testing meters, racks for storing meters, etc.—Lond. *Elec.*, October 27.

Measuring Instruments.—REYVAL.—An illustrated description of various voltmeters, ammeters and wattmeters exhibited at the Exposition at Liege.—*L'Eclairage Elec.*, September 30.

Condenser for Jump-Spark Coil.—An illustrated article giving complete instructions for the construction of a condenser for operation in conjunction with a jump-spark coil for gas engine ignition purposes.—*Amer. Elec.*, November.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Electric Transmission of Hand Writing.—ENGLISH.—An illustrated article on the invention and development of the Gray telautograph and a description of the instrument of Tiffany in its present form. At the transmitter a pencil is attached by rods to two lever-arms which carry contact rollers at their ends. These rollers bear against the surface of two current-carrying rheostats, connected to a constant-pressure source of direct current. The writing currents pass from the rheostats to the rollers and from them to the line wires. When the pencil is moved, as in writing, currents of varying strength go out upon the line wires. At the receiver these currents pass through two vertically movable coils, suspended by springs in magnetic fields, and the coils move up or down according to the strength of the line currents. The motions of the coils are communicated to levers similar to those at the transmitter, and on these levers is mounted the receiver pen, which, by the motion of the coils, is caused to duplicate the motions of the sending pencil.—*Jour. Franklin Institute*, October.

Meter-Testing Equipment.—ELLIS.—An illustrated description of a board designed for testing various kinds of meters. The author gives a diagram of connections for testing 500-volt, 220-volt and 110-volt direct-current meters; 220-volt and 110-volt alternating-current meters; 220-volt, three-wire, direct-current meters, and 220-volt, three-wire, alternating-current meters.—*Am. Elec.*, November.

Telephone Switchboard.—An illustrated description of a new multiple switchboard which has recently been taken into use at the Guernsey telephone exchange in England.—Lond. *Elec.*, October 20.

MISCELLANEOUS.

Rare Atmospheric Gases.—VALENTINER AND SCHMIDT.—Dewar has shown that charcoal at the temperature of liquid air possesses an extraordinarily high absorbing power for atmospheric gases, and has used this property for discovering hydrogen, helium and neon in comparatively small quantities of air. The present authors have employed this same property for manufacturing neon, krypton and xenon for spectrum tubes. To obtain the neon, they collected a quantity of argon, which contains neon, and led it over cocoanut charcoal kept at the temperature of liquid air. In this manner they liberated the neon, and avoided any admixture of nitrogen. The pressure had to be low, not exceeding a few millimetres. To free the neon from traces of helium, they occluded it in pure charcoal at a somewhat higher pressure and drove it out again. They thus obtained spectroscopically pure neon. To obtain krypton and xenon, they used charcoal at —120° C., which absorbs krypton and xenon completely, but only a little argon. They again eliminated the argon by connecting with a tube of charcoal in liquid air. Heating to —80° C. liberated pure krypton. A similar differential method enabled the authors to eliminate the krypton and to obtain spectroscopically pure xenon at —15°.—Lond. *Elec.*, October 27; from *Ann. der Phys.*, No. 11.

Liquid Air.—PICTET.—A paper read before the recent meeting of the Society of German Naturalists and Physicians. The author gives a review of the history and theory of liquefaction of air, and discusses the production and uses of commercial oxygen. After air has been liquefied, it is possible to keep it in liquid form at a pressure of two atmospheres. Nitrogen gas passes off first, afterwards oxygen which may be obtained in any desired purity. With a mix-

ture of oxygen and illuminating gas it is easy to produce a temperature of 3,300 to 3,400° C. Incandescent bodies in such a flame give, of course, a much brighter light than in a flame of a temperature of 1,500° C. The author demonstrated such a flame. The ordinary Welsbach mantles could not stand such a temperature, but the author says he has succeeded in producing suitable mantles. According to his statements oxygen made from liquid air costs 0.25 cent per cubic meter (the pressure not being stated).—*Zeit. f. Elek.* (Vienna), October 22.

Thawing Dynamite.—KELLY.—An illustrated article on thawing dynamite electrically in an underground magazine. The method is used in a mine in Michigan. The apparatus employed is described and illustrated.—*Mines and Minerals,* November.

Estimating on Contract Work.—AUERBACHER.—An illustrated article treating of the general subject of estimating from the viewpoint of the electrical contractor. Various expedients necessary to successful estimating are pointed out.—*Amer. Elec.,* November.

Swiss Electrical Society.—HERZOG.—A report on the recent general meeting of the Swiss Electrical Society in Freiburg. The presidential address urged very strongly a systematic study of the problem of electrifying railroads. The work of a committee appointed for this purpose is progressing rapidly, and it is suggested that the government should interest itself somewhat more in the subject. The society adopted a resolution protesting strongly against the municipal ownership of water powers. It is considered that monopolization of water powers by the government would be very detrimental to the electrical industries. Mosciciki read a paper on high-tension condensers and on disturbances in network due to electric discharges of high frequency and voltage. This paper will be dealt with in a separate abstract.—*Zeit. f. Elek.* (Vienna), October 15.

"Graft" In An Electrical Manufacturing Concern.

A recent litigation at Sandusky, Ohio, brought to light an extraordinary state of affairs in connection with the financial status and management of the Warren Electrical Manufacturing Company, of that city. The suit was started by Maria C. Warren, widow of the late C. C. Warren, and D. J. Mackey, as executors of the will of C. C. Warren. It was declared in the petition that the manager, Mr. L. G. Read, had endorsed paper aggregating $35,000 and that the company was mismanaged and so heavily in debt that it would become insolvent. The petitioners asked for the appointment of a receiver to protect their interest. The court had appointed H. W. Parsons receiver, and the defendants immediately filed a motion for a dissolution of the receivership. Mr. H. B. Warren, son of the dead president of the company, told of the contract by which machines were delivered to agents at a net price, all above this realized being the agent's commission. On one contract known as the Montpelier contract, the price paid was $22,700, while the company secured only $14,062. The remainder was the agent's commission. The sale was made by L. G. Read, who is manager of the company, as there was credited to him, as commission, $6,750, of which $3,250 was paid in cash, although the machine was not yet completed.

When Mr. Read took the witness stand he told of a sale of a turbo-generator to an Eastern light and power company for $21,750. The Warren Company got a little over $15,000 for the machine, but Mr. Read, as agent, did not get the rest. He said that he dickered a long time with the president of the power company, naming both the company and the president, and the president finally agreed to let the contract to him if the sale was made on a basis of $19,500 as actual cost, to be billed in to the company for $21,750 and the president to get the difference as a "rake off." It was so ordered and the president was sent a present of a Warren Electric Company's check for $2,250.

As to the manner of getting loans, Mr. H. B. Warren testified that for $2,500 borrowed from the Euclid Avenue Trust Company, of Cleveland, the trust company charged the market rate of interest, took $1.50 in bonds as collateral for every dollar borrowed and in addition charged 10 per cent for making the loan.

As the result of the hearing Receiver W. H. Parsons was removed and James Flynn, R. E. Schuck and John Whitworth, three bankers, were put in charge of the plant to operate it under the court's order. The resignation of L. G. Read as manager was at once demanded.

Judge Reed, who tried the case, said that he had no doubt that under the management of the late C. C. Warren the business grew and the concern prospered. He designated it as "poor business" when L. G. Read was made manager following Mr. Warren's death. Mr. Read was, prior to that time, a selling agent and only a short time prior to Mr. Warren's death made a long-time contract for the entire output of the Warren Company's plant. His subsequent election as manager of the plant made it so that he fixed the price at which the company's products were sold to him.

In regard to the $2,250 Manager Read admitted on the stand he had allowed the president of a purchasing corporation, Judge Reed remarked: "I was shocked at the statement of Mr. Read that he deliberately paid the president of this company $2,250 as an inducement to buy. It may be the usual thing in business, but I give very little credit to the word of a man who admits he bribed an officer of another corporation. He does not come into court with very clean hands and is entitled to very little consideration at my hands."

An effort was made by Mr. Read not to have his testimony in regard to the bribe go on record. He asked the court to have it stricken out. "Mr. Read," was the court's reply, "I will have you understand that everything in this court is open and above board and there will be no whitewashing here. The record will stand."

The court commented unfavorably on the fact that the company had found it necessary to pay a bonus of 10 per cent in addition to the customary interest in order to float a loan. "It certainly shows that the company's credit was exhausted or there was very poor management," said the court, "if it was necessary to give a bonus of $2,800 in order to secure a loan of $28,000, as has been testified to."

In conclusion the court said he thought the company should be a paying institution. He remarked that it seemed queer, to say the least, that small bills for two or three dollars would be refused payment when the manager was paid $4,000 as a commission for a sale and the president of a buying company a bribe of $2,500. "The management of Mr. Read has been detrimental," said the court, "for the benefit of a few individuals getting a rake-off."

New Flaming Arc Lamp.

The rapidly extending use in Europe of the flaming arc lamp, and the favorable attention which the relatively few installations thus far made in this country have attracted, indicate that this type of lamp must now be considered a live factor in the electric lighting field. The American Beck Arc Light Company, 1591 Broadway, New York, has been formed to take over the American rights and will manufacture one of the most popular of European flaming arc lamps, and is now about ready to place the lamp on the market. This lamp is the invention of Heinrich Beck, of Meiningen, Germany, and is remarkable for its simple construction, which will be described farther on.

Composite carbons are used and therefore any color within the practicable range of lighting, running all the way from white through yellow to red, may be obtained at will. The lamp burns with a long arc, but owing to the flaming arc the voltage at the terminals is about the same as for the ordinary open arc, ranging from 42 to 46 volts. The current is from 6 to 12 amp. for both direct and alternating current, the candle-power corresponding to the latter current being 3,800 cp, all of which is distributed below the horizontal for reasons that will be seen later. For the 9-amp. lamp the diameter of the positive carbon is about ⅓ in. (8 mm.), and that of the negative carbon is slightly smaller (7.5 mm.). The length of the carbon is about 12 in. (330 mm.) for the smallest type of lamp, which gives a carbon life of eight hours. The lamps, however, are built for carbon lengths up to 26 in. (550 mm.). Prof. Wedding, the German authority on illumination, has tested a direct-current lamp for 9.1 amp. at 42.2 volts, which gave, without globe, 2,464 hemispherical candle-power, corresponding to a consumption of 0.163 watt per candle—an economy almost four times as great as that of the ordinary open arc lamp, which latter is at least twice as efficient as the best enclosed arc lamp.

The construction of the lamp is shown diagrammatically by Fig. 1. The carbons are arranged side by side in a slightly inclined position. One carbon is fixed, with respect to its longitudinal direc-

tion, the other being adjusted in position by means of the lever shown at the top. This lever is operated by means of an electromagnet, shown in the center at the top of the lamp. When no current flows the two carbons touch each other at their terminals at the bottom. When the circuit is closed the right-hand carbon is deviated sideways and the arc is started. The deviation of the

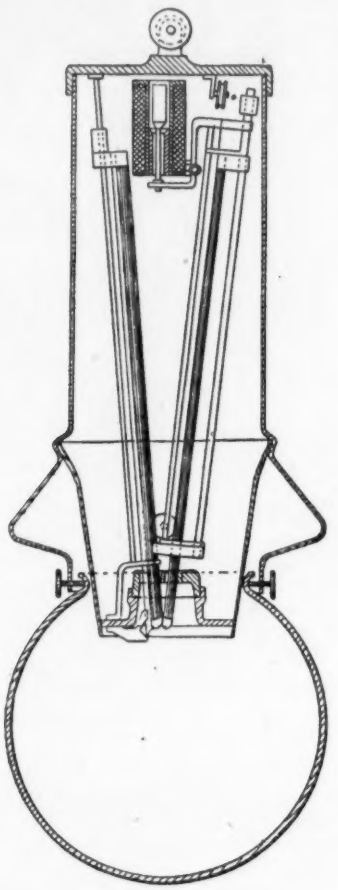


FIG. 1.—FLAMING ARC LAMP.

right-hand carbon is limited so that a constant distance between the two carbons is maintained. The electromagnet contains only a few windings through which the main current flows.

The lower terminals of the carbons are surrounded by a cast-iron

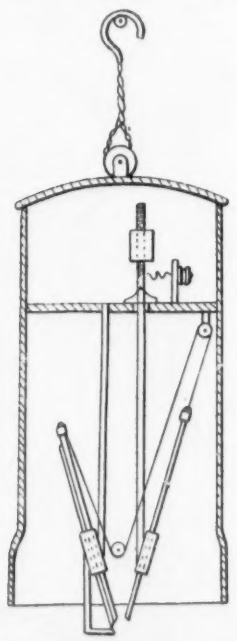


FIG. 2.—FLAMING ARC LAMP.

reflector, the inside of which is of white enamel. The left carbon (for direct current usually the positive carbon) has not an exactly circular cross-section, but is provided with a rib, which is shown at the left, and by means of which it rests on a support mounted at the bottom of the reflector. Above the lower supporting surface there is provided a small chamber surrounding the carbon rib and protecting it from the air. The purpose is to let the carbon burn off in such a way that a fine point always remains at the end of the rib, and on this point the left carbon rests. It burns off very uniformly and slowly, so that the carbon electrode is fed downward very gradually and uniformly. The support on which the fine terminal point of the carbon rib rests remains relatively cold. The right-hand carbon, which has a completely circular cross-section, is fed downward simultaneously with the left-hand carbon by means of the mechanism shown in Fig. 2.

Automatic Switchless Telephone.

The mechanism of the complete automatic switchless telephone, shown in Fig. 1, is composed of a built-up frame of heavy sawed brass, with a sliding plate in the center. The push buttons are made of hard-drawn cone-shaped brass, with a hard-steel pin on one end and a hard-rubber button on the other. There are no spiral springs used on this mechanism. The buttons are held and worked by a heavy hard-drawn bronze spring, bent on one end for the line

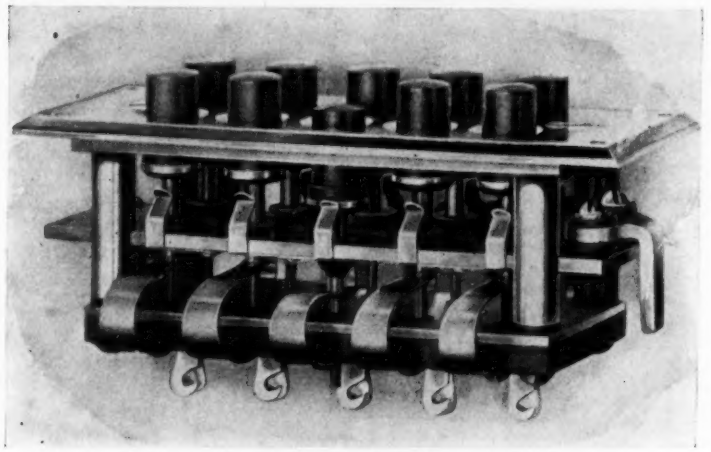


FIG. 1.—AUTOMATIC TELEPHONE PUSH BUTTONS.

terminal. Pressing the button all the way in will give the ringing circuit; on its return the button makes two self-cleaning, talking contacts. When the conversation is completed, the placing of the receiver on the hook causes the button to be released. The self-cleaning contacts are stated to eliminate the trouble due to acid, dust and corrosive fumes.

The self-cleaning contact spring is of hard-drawn bronze. It is fastened to the talking plate by rivets and so bent up that every time a button is pressed, the spring makes two or more scraping contacts before it comes to rest. The cone-shaped push button on the sliding plate is also equipped with a scraping contact. Either of these contacts will cut through any foreign matter.

Fig. 2 shows the mechanical details of the push buttons. The

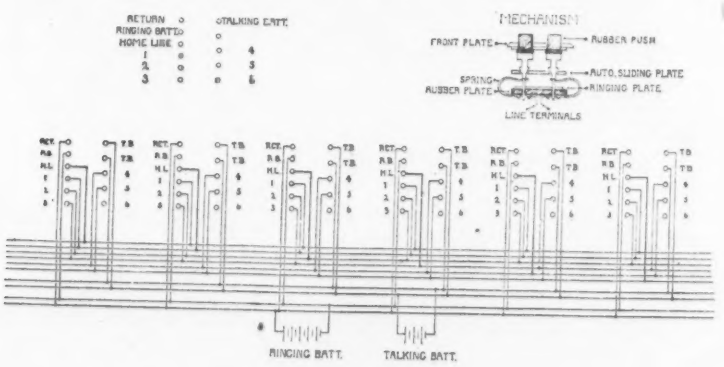


FIG. 2.—DIAGRAM OF TELEPHONE CONNECTIONS.

circuits indicated in Fig. 2 are intended for a six-station system, for which 10 wires are required, when there is used a separate bank of batteries for ringing and talking. The same general scheme can be employed for systems having any number of stations not ex-

ceeding 50, by using in each case four more wires than there are telephones. The manufacturer of the automatic switchless telephone is the De Veau Telephone Manufacturing Company, New York.

Portable Moving Coil Galvanometer.

The portable moving-coil galvanometer illustrated in Fig. 1 is equipped with a novel form of moving system and filament suspension which is claimed to avoid the initial friction to be overcome when jewel bearings are adopted as a means of suspension and to permit high sensibility. The suspension consists of upper and lower filaments, and in this particular it differs from the pivot-and-jewel suspension as ordinarily used in instruments of the portable type.

The magnetic field is produced by a U-shaped cast-iron permanent magnet, Figs. 2 and 3, having inwardly directed poles at one end so as to have north polarity only on one side of the air gap, separating the poles, and south polarity only on the other side of the air gap. The magnet is slotted so as to accommodate the moving system, as shown. The air gap between the poles being very short, the field is uniform and intense.

The moving system consists of four flat coils of very fine wire, wound alternately in opposite directions, so as to produce alternate north and south poles when viewed from one side. These coils are held between two aluminum discs, and suspended in such a manner that normally only a portion of each coil extends into the air-gap between the magnet poles, though at all times only about one-half of the coil surface is between the pole faces. It is evident, therefore,

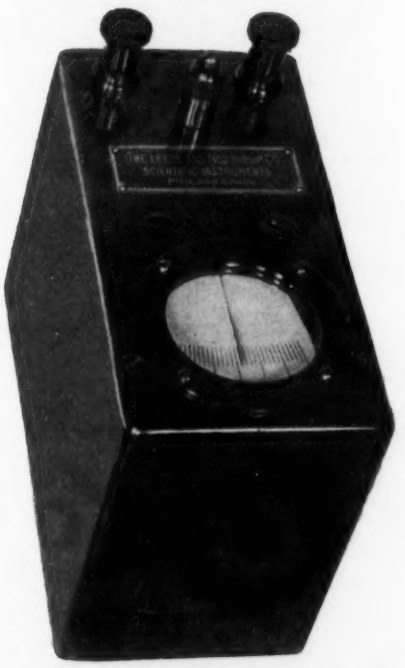
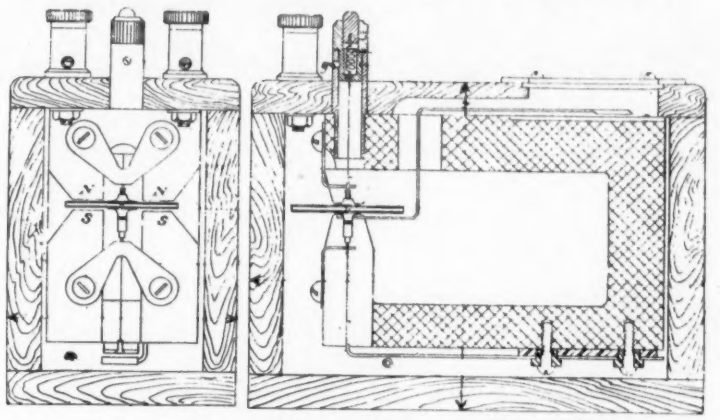


FIG. 1.—PORTABLE MOVING-COIL GALVANOMETER.

that when current is passed through the coils, two of the coils of a certain polarity will tend to swing around to inclose the greatest number of lines of force, while the other two coils of opposite polarity will be repelled. The aluminum discs also serve the purpose of damping the system and rendering it dead-beat. The galvanometer can be given a high, medium or low resistance by connecting the coils in series, series-parallel, or parallel.

The suspensions consist of three-wire filaments of a high tensile strength, which are non-corrosive. To give the entire system resiliency in the event of sudden jars, the upper suspension terminates in a spiral spring, and the lower suspension is attached to a long flat phosphor bronze spring. An additional protection against excessive strains on the moving system is provided by means of two guards, which have clearance holes to provide for the rotation of the system around its axis of suspension and to limit the sidewise play of the system, thereby arresting the movement of the coil due to any sudden shock. The movement of the system vertically is limited by the pole-faces of the magnet, which also prevents breaking of the wire filaments.

A torsion head provides a delicate zero adjustment, and by means of a screw operating in an annular groove, it engages the end of the groove and thus acts as a stop to limit the extent to which the torsion head may be turned, and, therefore, prevents the suspension filament from being twisted off by turning the adjusting head too far.



FIGS. 2 AND 3.—SECTIONAL VIEWS OF GALVANOMETER.

The magnet with its complete moving system and scale is mounted in a highly polished mahogany case, as shown in Fig. 1. A circular opening in the top protected by a glass window provides for the visibility of the scale. This instrument is being placed on the market by the Leeds & Northrup Company, 259 N. Broad St., Philadelphia.

A Safety Line Disconnector.

A device for automatically disconnecting and rendering harmless all broken ends of wires hanging down from poles is being made by the G. & W. Electric Specialty Company, of Chicago, after having been perfected on the lines of the Commonwealth Electric Company, of that city. Fig. 1 shows these automatic line disconnecters as they will appear placed in a high-tension line at a crossing with telephone lines. The object of the device is to provide something safer and more satisfactory than guard wire net works under high-tension lines. The recommendations of the underwriters for such crossings are for extra high poles set close together

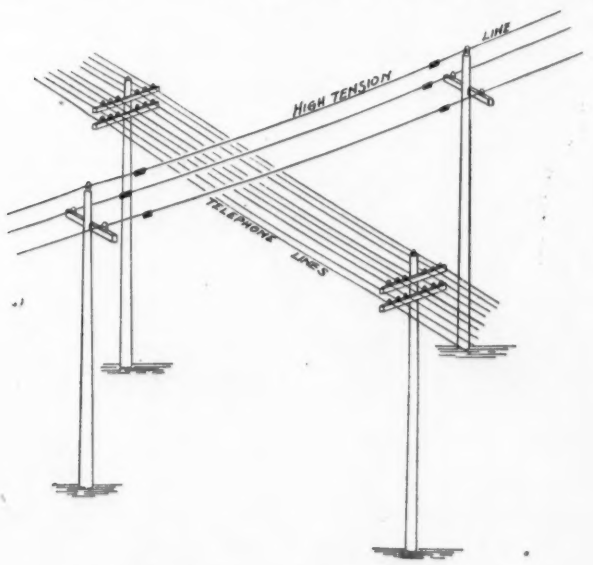


FIG. 1.—APPLICATION OF LINE DISCONNECTOR.

at crossings, so that if the wire breaks the broken ends will not be long enough to reach down to the telephone wires below. It is not always possible thus to locate poles.

This line connector is so constructed that, as soon as the tension on the line is removed, a powerful spring will disengage the device and disconnect the broken section. This spring acts so quickly as to prevent even a momentary contact between the high-tension wire and the wires crossing below it. The disengaging spring and hook are protected from the weather by a hood, which also prevents sleet from interfering with the operation of the device. Referring to Fig. 2, the parts *G*, *D*, *E* and *F* have been removed from the hood

C to show their construction more clearly. The piece *D* is held in the hood by the screw shown on the side of the hood directly above it. The spring *G* is held in the hood by the screw directly above it. The hook *F* has a slot in the middle to receive the spring. When placing the device in a line the hook is placed against the spring and pressed up until it rests against the cross-piece *D*. The tension is then placed on the line, which holds the hook in place until the tension is released by the breaking of the wire, when the spring throws the hook out and disconnects the line. Two sizes are made, one for use on high-voltage wires and the other for telephone and telegraph wires where they must cross above high-tension lines. The type illustrated is the one made for telephone wires. In the device as made for high-tension wires, terminals are provided which permit of soldered connections giving a current-carrying capacity equal to that of the wire. The connections

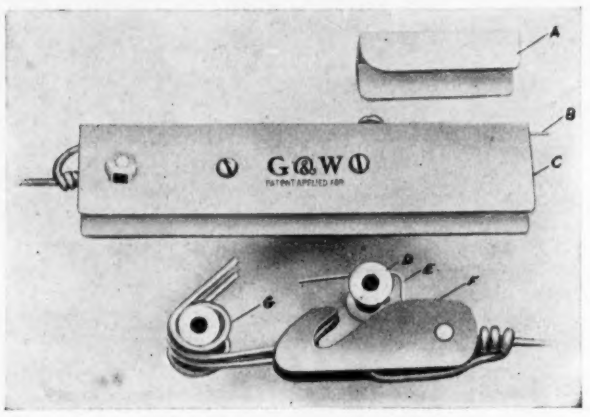


FIG. 2.—DETAILS OF LINE DISCONNECTOR.

on the telephone wire disconnector are also soldered. This soldering is done in manufacture, and the device is furnished with wire terminals attached. To provide against the possibility of a moving contact interfering with good service on the telephone line, the hook contact of the device is bridged by a wire, *E*, Fig. 2, one end of which is soldered to the inside of the hood. The other passes into a hole in the hook of about ⅛ in. diameter and ½ in. tip, which forms a mercury well. The top of the mercury well is soldered with paraffine wax while the hook is being put in position to prevent the mercury being spilled.

Split Porcelain Insulator.

The accompanying illustrations show an insulator which has been designed to eliminate the objectionable tie wire. Each insulator is made in two parts. The slot in each part is given a certain oval curvature. The oval shape enables the hole for the screw to be

FIG. 1.—INSULATOR COMPLETE.

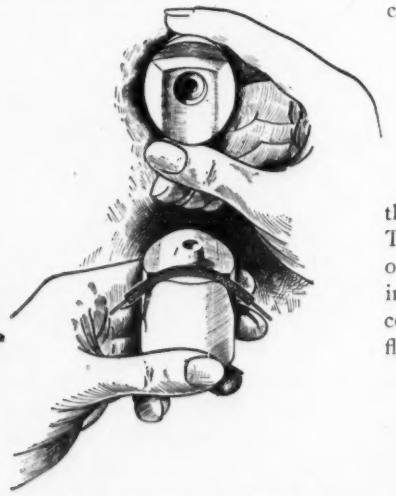
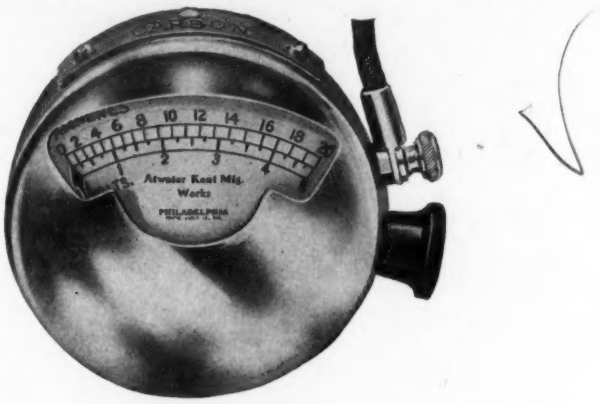


FIG. 2.—DETAILS OF INSULATOR.

placed in the center, while the wire is held securely in place on account of the curve between the two parts which are forced against the wire. Fig. 1 shows the insulator complete while Fig. 2 shows the general construction of the insulator. This insulator is manufactured by the Star Porcelain Company, Trenton, N. J.

Volt-Ammeter for Battery Circuits.

The volt-ammeter shown in the illustration herewith has been designed especially for use with primary batteries. The scale of each meter is graduated by hand when it is calibrated by comparison with standardized apparatus. An advantageous feature which has recently



VOLT-AMMETER.

been introduced in these instruments resides in the "dead-beat" needle which, on account of its quickness in coming to rest, assures a quick and accurate reading. These instruments are manufactured by the Atwater Kent Manufacturing Works, 112 North Sixth Street, Philadelphia.

A Pocket Live Wire Indicator.

The Minerallac Company, of Chicago, has received notification that it has just been awarded a prize of 500 francs and given honorable mention by the Association des Industriels de France for its small device known as the "Electroscope," which is for use by linemen and all working where there may be live conductors, to indicate the presence of dangerous potentials on conductors. This French institution opened a competition something over a year ago for an indicating instrument which could be used by those working around

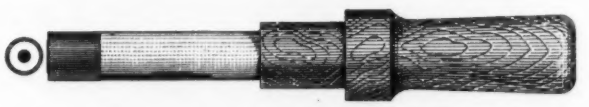


FIG. 1.—LIVE WIRE INDICATOR.

high-tension conductors, to determine whether conductors about to be handled had been cut out or were still alive. The electroscope is an extremely simple device, as shown in Figs. 1, 2 and 3. It is merely a glass tube on one end of which is secured a metal cap, which carries a strip of metal projecting some distance into the tube. On

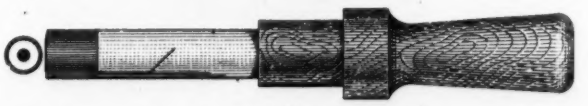


FIG. 2.—LIVE WIRE INDICATOR.

this strip of metal is mounted the indicating leaf of the electroscope. The metal cap is hermetically sealed, in addition to being screwed on to the end of the tube so as to prevent moisture from getting into the tube. When the tip of the electroscope is held near a dead conductor, there is no indication and the indicating silver leaf lies flat in the bottom of the tube, as in Fig. 1. When the tip of the elec-

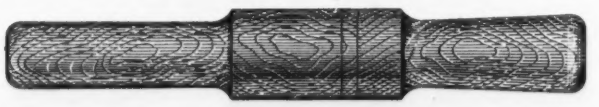


FIG. 3.—CASE FOR INDICATOR.

troscope is held near a live conductor, the indicating leaf rises, as in Fig. 2. The pocket size of this instrument is kept in a light aluminum case, while the station size, which is that shown, is in a heavier wooden case, so that it can be kept in tool boxes. As ordinarily made, this electroscope will indicate positively on voltages

as low as 500 volts. It could be made to indicate on lower voltages, but in such case the indicating leaf would be so light as to tear itself to pieces when held near high-tension conductors. It goes without saying that some positive, quick method of testing for live conductors is very desirable when men are working around oil switches or on lines, as there is always a chance for a mistake or misinformation as to which high-tension lines have been cut out at the switchboard. By trying it on each side of a primary fuse box, indications will show if the fuse is blown. Those accustomed to using the device can also learn to judge approximately the potential a line is carrying by the distance from the conductor that the instrument must be placed to indicate. It is of course not useful for indicating potential on lead-covered cables before the lead sheath is removed.

Blower for Hot Gases.

Experience has shown that in handling hot gases with a fan, as in a plant producing induced draft for boilers, it is impossible to give the fan shaft a suitable bearing at the inlet side. A bearing here would necessarily be situated in the inlet area and would be constantly surrounded by hot flue gases. Much better results have been obtained by the use of an overhung wheel, having, in addition to the two engine bearings, a bearing on the engine side of the fan, but none on the inlet side. The usual form of construction, which requires

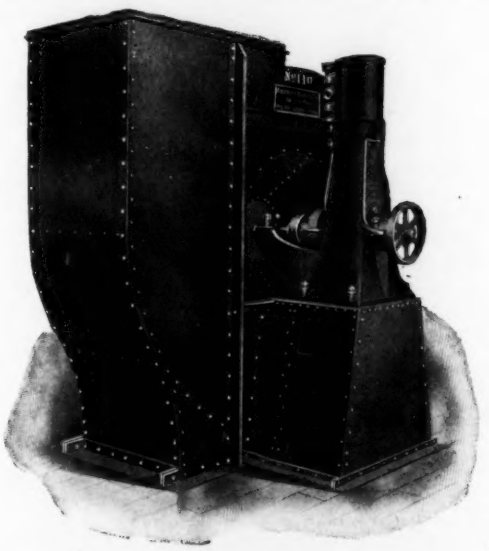


FIG. 1.—BLOWER FOR HOT GASES.

FIG. 2.—DESIGN OF SINGLE-SPIDER WHEEL.

a third bearing separate from the engine, has, however, given trouble from the fact that this bearing cannot readily be lined up with the two engine bearings.

In Fig. 1 is shown a new method of construction which has been designed to overcome this trouble. All of the journal boxes are cast in the engine frame and can be bored with the same boring bar. Thus it is impossible for them to be out of line. The fan bearing is water-cooled and ring-oiled. From the fact that all bearings are bored at once, a self-aligning bearing, such as would otherwise be necessary, is not required here, so that the arrangement is still further simplified. In addition to these points, it will be noticed that the bearing is supported by the engine bed and not by the housing of the fan as would otherwise be the case. This disposal simplifies the construction by doing away with the additional bracing usually found on fan housings.

The wheel, shown in Fig. 2, is varied somewhat from the ordinary construction. In place of the usual three spiders, is substituted one heavier one, built of I-beams cast into the hub. The blades are braced upon each other, as shown in the cut. The wheel constructed in this manner has been shown to be fully as strong and rigid as the ordinary three-spider form.

The engine is of the enclosed type, oiled by a recently devised pump which distributes copious streams of oil all over all of the reciprocating and revolving parts, even lubricating the eccentric outside of the frame. Tests in actual practice have proven that it will run several months without oiling or adjustment. This outfit is manufactured by the American Blower Company of Detroit, Michigan.

Battery Fan Motors.

The usefulness of the fan motor has long been appreciated by consumers of central station and isolated plant current, and each year records more extended applications of improved designs in portable and stationary fans. Although the vast majority of fan motors in commercial service are operated upon lighting or power circuits, the field of usefulness of fans run by battery current is constantly expanding. The storage battery is a most convenient source of power for small fan motor work, in installations where the dynamo equipment is supplemented in this way, for the energy consumed by a modern fan motor of first class design does not exceed that required by a 16-cp incandescent lamp, and consequently a considerable number of fan motors can be operated at any convenient voltage from a power house or sub-station battery without noticeable interference with its discharge capacity.

There has arisen of late a commercial demand for a fan motor capable of being operated upon a primary battery circuit in locations where central station or isolated plant power is not available. This requirement has been met by the manufacturers in the design of motors capable of performing good service with a remarkably low operating expense considering the unfavorable aspects of economical current generation by chemical means. An illustration occurs in the case of a 9-in. fan battery motor now on the market which operates 150 hours on a single battery charge at a cost of about 3.5 cents per hour. The first cost of the entire outfit, including a spring suspension bracket, four cells of battery, a containing box, flexible cord, fan and guard is but $25, and the motor alone may be purchased for about $13. Equipped with ball bearings, which greatly decrease the friction losses, such a motor is adapted to high-speed operation and is in no sense a toy, despite its being designed for less than 3 volts full potential. The battery occupies less than 2 cu. ft. of space and the motor with its fan an area of only 120 sq. in. Another battery motor, equipped with a 7-in. fan, will operate 150 hours at an expense of about 2.5 cents per hour, drawing its current from three cells of battery giving a total e.m.f. of but 2.1 volts. Such an outfit costs in the beginning but $18, of which about $8.50 may be charged to the motor and fan.

Perhaps the most useful application of these motors is found in the sick room, where good ventilation is imperative. There are still many homes which are out of the reach of central station circuits, but which none the less are in need of the service which the fan motor can supply. It is certainly quite worth while, in a well-to-do rural community, to employ the battery fan motor in hot weather to alleviate the discomforts of sultry days, and in the winter season the part which such an equipment plays in the freshening up of a sick room may well become an important factor in the patient's recovery. Noiselessness is a prime essential, however, and it is important to avoid turning the air current directly upon a patient—a proceeding which has at times been followed by serious results, including the discrediting of the fan motor itself.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—There is no reason for complaint over the trade and industrial conditions, since excellent reports are made from nearly all lines. Free movement of freight is hampered, however, by car congestion in widely separated sections, which plight affects prices and collections. Trade continues to receive stimulus from the cold weather, and sales compare well with those of a year ago. Jobbers and wholesalers report some change of activity from staple lines to holiday specialties, and manufacturers of such goods are working full time. Intense activity characterizes industry, the past month being a record-breaker in all lines of iron and steel. Touching upon this subject the *Iron Age* says the monthly statistics show that there were produced by the anthracite and coke furnaces of the United States, 2,053,127 tons of pig iron, which compares with the previous achievement of 1,963,717 tons in May. Both figures do not include the output of charcoal pig, which may be estimated at about 30,000 tons a month. The steel companies produced 1,370,960 tons in October, as compared with 1,287,438 tons in May. Of this October product the United States Steel Corporation had 950,752 tons. How enormous the output of the steel works is, is proved by the record of the plants of the United States Steel Corporation, which, in October, produced 1,172,951 gross tons of ingots. The pressure for deliveries in the structural trade is enormous. The New York & New Jersey Railroad Company, which is building the so-called McAdoo tunnel, has awarded the second contract to the Bethlehem Steel Company, for steel and iron castings for use in the tunnel. The company will require about 73,000 tons before the work is completed, and another contract will probably be let before the end of the year. Prices of staples show marked strength, and, in a majority of cases, are higher. Money is in active request in the country, and the demand on account of crop movement is unabated. The strength of demand and of prices in many industries is perhaps the most marked feature of the present season's unprecedented trade. Iron and steel, lumber, all other building materials, cotton and cotton goods, and hides, leather and shoes show strength never heretofore surpassed. The recent advance in the price of cotton has caused more sales at the South, with good results upon trade and collections. Labor is scarce, however, and complaint is made that the crop cannot be picked promptly. There is a less foreign demand for cereals, but foreigners display a tendency to come into the market at lower prices. At home the reactionary tone of last week continues. Railway tonnage is very heavy, only a paucity of transportation facilities preventing further expansion. The gross earnings for October will probably show an increase of 6 per cent over the same month last year. In the metal market, copper was very dull, consumers being apparently well supplied for present needs. Lake and electrolytic sold at 16½c., and casting stock is held at 16¼c. *Bradstreet's* reports 166 business failures in the week ending Nov. 9, compared with 160 the week previous, and 184 in the corresponding week last year.

THE AMERICAN WOOLEN COMPANY, of Boston, Mass., through its president, William M. Wood, has just signed a contract with the Otis Elevator Company, of New York, for four escalators to be installed in the new "Wood" worsted mill which is being built at Lawrence. This is the first factory installation of the escalator on record, and, in fact, one of the first instances where provision has been made in a factory equipment for mechanical means of elevating employees from the surface level to the various floors. The "Wood" worsted mill will be one of the largest single factory buildings in the world, contemplating an ultimate capacity of 5,000 hands. The escalators are to be installed in a special building situated between the wings of the factory proper and adjoining and connected with the factory entrance, which is at the second floor. Two escalators will run in parallel from the second to the fourth floor, it being contemplated that employees shall either walk from the fourth to the third floor or ascend by ordinary stairs from the second to the third floor. One escalator will run from the fourth to the fifth floor and one from the fourth to the sixth floor. Although this escalator installation involves an investment of approximately $100,000, it is calculated by the management of the American Woolen Company that the enhanced efficiency of the employees will more than offset the interest on the investment, most of the employees being women, and the injurious effects of stair-climbing upon women being recognized as more serious than the mere consumption of muscular effort. It is estimated that 100 ordinary elevators would be required to furnish an equivalent service.

MAGNETO-ELECTRIC COMPANY.—The property of the Magneto-Electric Company, of Amsterdam, N. Y., has been sold in that city to satisfy a judgment foreclosure action brought by the United States Mortgage & Trust Company. Contractor Fred Conrad made the first bid, which was $15,000. This was raised to $20,000 by Attorney Dodd, representing the bondholders, and as there were no other bids it was accordingly struck down to him. Steps will now be immediately taken to effect the organization of the new electric company, which will have the present building, and then it is expected the plant will be started. The New Electric Manufacturing Company, of Amsterdam, capital $250,000, has been incorporated to take over the property, with Roy W. Brown, George I. Herrick, John E. Larrabee, Richard Murphy and Waldimer C. Schaufler, of Amsterdam, and Eugene Moore and Frank D. Oliver, of Johnstown, as directors.

LIGHTING IN CONNECTICUT.—Mr. Burdett Loomis, of Hartford, representing a syndicate of Philadelphia capitalists, has acquired a controlling interest in the capital stock of the Windsor Locks Electric Lighting Company. The price paid for the control was $200 a share. The company has a capital stock of $20,000, and it also has outstanding a $30,000 issue of 4½ per cent bonds, which mature in 1922. The company pays a regular dividend of 6 per cent, and it recently declared an extra of 4 per cent. It is expected that the new owners will expand the plant and operate it for power and light, both night and day. A gas plant will probably be added to the equipment at an early date.

KOERTING GAS ENGINES.—It is reported that the De La Vergne Machine Company, of New York, which has recently completed its contract for 40,000 hp of Koerting two-cycle double-acting gas engines, of which 32,000 hp is employed for driving blowing engines, and 8,000 horse-power for driving direct current, and polyphase alternating current generators, have recently been given a contract for three 500 hp Koerting gas engines to be direct connected to 325 kw, 550-volt direct-current Crocker-Wheeler generators for the Boston Elevated Company. These engines will be put in operation about Jan. 1, 1906.

CATALOGUES FOR BELIZE, B. H.—Mr. Joseph Lewis, proprietor of the Belize Ice & Distilled Waterworks, etc., Belize, British Honduras, S. A., has closed a contract with the colony government to furnish light and power for a period of 30 years, and wishes to get catalogues, with lowest cash prices, for electrical machinery, fixtures and supplies. He does not state the terms or nature of the contract. He also wishes quotations on batteries for automobiles and launches.

G. M. GEST, the expert subway contractor of New York and Cincinnati, has been awarded the contract for the construction of a complete subway system at Chattanooga, Tenn., for the East Tennessee Bell Telephone Company. Active work on construction of this contract was commenced last week and is to be rushed to a speedy conclusion. This is the first conduit work installed in the city of Chattanooga and the system will be a large one.

THE STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY, Rochester, N. Y., reports having closed contracts for switchboards for the following places: Friendly, W. Va.; Sistersville, W. Va.; New Matamoras, Ohio; Laclede, Mo.; Long Lake, Minn.; Eureka, Utah; Payson, Utah; Richmond, Utah; Tooele, Utah; Preston, Idaho; Lowville, N. Y.; Louisville, Ky.; Attica, Ind., and Rochester, N. Y.

PLANT FOR HOOPESTON, ILL.—The city council of Hoopeston, Ill., has granted a fifty years franchise to Mr. Charles J. Wakeman for a gas and an electric lighting plant. It is proposed to rebuild the electric plant and to put in gas works. Mr. Wakeman is the president and manager of the present Hoopeston Electric Lighting & Heating Co., which has Westinghouse and Fort Wayne apparatus for lighting and a day power circuit.

FACTORY FOR SUPPLIES.—It is stated by the Middletown, Conn., *Press* that Mr. Farley Osgood, general manager of the New Milford Power Company, has bought the Wannopee pottery buildings, which will be used for the manufacture of electrical supplies.

RAILROAD SIGNAL EQUIPMENT.—The New York Central has closed a contract with the Hall Signal Company for the equipment of the West Shore Railroad from West Cornwall to Haverstraw with normal danger automatic block signals.

JAPANESE ELECTRIC ORDERS.—Takata & Co., engineering department reports the following recent orders from Japan for Westinghouse machinery, etc.: Takata & Co., Tokio—Ten 1-kw, type "N" transformers, 7,200 alternations; twenty 2-kw type "N" transformers, 7,200 alternations; twenty 3-kw type "N" transformers, 7,200 alternations; twenty 4-kw type "N" transformers, 7,200 alternations; twenty-five 5-kw type "N" transformers, 7,200 alternations; ten 7½-kw type "N" transformers, 7,200 alternations. Osaka Arsenal—One portable wattmeter, single-phase, 7,200 alternations; one portable voltmeter, direct current and alternating current; one portable ammeter, alternating current. Nagoya Industrial School—Two 10-hp, shunt-wound, type "S" motors, 110 volts; two type "K," direct-current, 120-amp. ammeters. Osaka Arsenal—Two type 8-A, 250-volt, three-phase, feeder panels, an extension to a previous Westinghouse installation. Ashio Mine—Three 150-hp, 2,000-volt, 6,000-alternations, three-phase, type "C," alternating-current induction motors; two 25-hp, 500-volt, 6,000-alternations, three-phase, type "C" induction motors; one 15-hp, 500-volt, 6,000-alternations, three-phase, type "C" induction motors; one 15-hp, 500-volt, 6,000-alternations, three-phase, type "C" induction motor, arranged for gear connection to a countershaft, complete with Laminar fibre motor pinions, gear wheel, etc.; six 75-kw, 2,000-520-volt, 6,000-alternation transformers; three 50-kw, 2,000-520-volt, 6,000-alternation transformers. Takata & Co., Tokio—Ten direct-current, enclosed arc lamps, series potential, 200-220 volts, 16 series resistances. Hokkaido Tanko Railway Company—One 75-kw, single-phase, alternating-current, revolving-armature generator, 7,200 alternations, 2,200 volts, 720 r.p.m., driven by a Westinghouse standard engine, 13½ by 12; one 2-kw, 125-volt exciter for the above generator; one marble switchboard consisting of one exciter panel, one generator panel, one feeder panel, for the control of the generator and the exciter mentioned above, together with three feeders; ten 5-kw, type "B" transformers; five 3-kw, type "B" transformers.

ELECTRIC BARK GRINDING.—The Public Service Corporation's bulletin, *Light and Power*, for October, says: "Early every spring in Virginia, Mississippi, Missouri and other Southern States, men, carrying what they call a 'spud' go far into the lumber regions to strip the bark from the trees, while the sap is running. Large quantities of this bark, in about 4-ft. lengths, is shipped to the mills of H. Stacey Smith. Two of these are located in Virginia, while the other is at 565 Ferry Street, Newark. The bark, shipped to the Newark mill, is largely chestnut-oak and hemlock, these two being especially adapted to the tanning of patent leather for which Newark is celebrated, about 75 per cent of that product used in the United States being made in that city. In preparing the bark for this trade rock oak, found only north of the Mason and Dixon line, is also used. When the bark, received by the car load, is thoroughly dry, it must be ground or shredded to be of use in leather tanning. H. Stacey Smith has the only mill for this work in Newark. He has installed for his process a 35-hp electric motor to operate a patent crushing machine, which instead of grinding, tears the bark apart. There are many by-products for which the dust of the bark may be used so that no waste is allowed. In the large yard back of the mill is 3,000 or 4,000 tons of bark. These are emergency piles, used only when there is a delay in the regular shipments. The United Electric Company installed the motor now in use there."

WIRELESS AND STOWAWAYS.—The Atlantic De Forest Wireless Company sends us the following report from the De Forest operator on the steamship *Coamo*, from San Juan. The steamship *Ponce* and *Coamo* are equipped with the De Forest system: "On last Wednesday, November 8, when the steamship *Coamo*, of the New York & Porto Rico Steamship Company Line, was about 300 miles from San Juan on her return trip to New York, the captain discovered two boys, stowaways, aboard. The steamship *Ponce*, of the same line, was about 100 miles away when Captain Sargent sent a wireless message to Captain Dalton, of the *Ponce*, giving his position and asking if he would take the boys back to San Juan. The captain of the *Ponce* replied, agreeing to do so, also giving his latitude and longitude. The *Coamo's* course was then changed and when the two vessels hove in sight, four hours later, they were end on coming within a few hundred yards of each other. A boat was manned and the stowaways were transferred with a delay of less than ten minutes actual time, a feat which would have been absolutely impossible without the use of wireless telegraphy."

TELEPHONY AT GRAND RAPIDS.—Mr. E. B. Fisher, secretary of the Grand Rapids, (Mich.) Citizens' Telephone Company, writes to the Automatic Telephone Company, of Chicago, as follows: "We have had a net gain of 829 telephones in the Grand Rapids Exchange since January 1 last, which is a more rapid rate of growth than we enjoyed last year. Also we have a net gain of 83 telephones so far this month, and still they come, and this without solicitation on our part. The exchange this morning had 6,784 telephones in service, and we shall undoubtedly pass the 7,000 mark before the holidays, for we have between 60 and 70 orders on the books to fill. We began service with the Automatic apparatus on January 9, 1904, displacing a manual telephone exchange with 5,094 telephones. Soon after the change to Automatic equipment we made a general increase in our rates amounting to $6 per telephone for business telephones and $4 per telephone for residence service per annum. Notwithstanding the increased price of service the list of subscribers has shown a net gain of 1,629 in approximately 20 months."

POWER IN WASHINGTON STATE.—Secretary S. Deas Sinkler, of the Northwestern Gas & Electric Company has issued notices that there will be a meeting of stockholders at Walla Walla, Dec. 21, for the purpose of voting on the proposition of increasing the capital stock of the company from $650,000 to $1,000,000 by the issuance of $350,000 8 per cent cumulative preferred stock, entitled to priority, both as to dividends and in the distribution of the assets upon dissolution of the company. This has given rise to new rumors that another electric plant is to be erected on the Walla Walla river on what is known as the Roberts ranch, five miles above the big power house erected by the company two years ago, and which now supplies Walla Walla, Athena, Weston and Pendleton with power. Increasing demand for power and the fact that the street car line to be installed in Walla Walla by a branch company of the Northwestern company will need several hundred horsepower is said to be responsible for increasing the facilities. Local representatives of the company say the increased capital stock will be used for improvements.

LIGHTING APPARATUS WANTED.—The Springfield (Ky). Water & Electric Light Company (Incorporated), contemplates enlarging its lighting plant. They now have two 100 hp boilers, one Chandler & Taylor automatic engine, and one 60 kw Wiley generator belt connected. For the new plant they want a 125 to 150 hp tubular boiler, a 100 to 125 kw direct connected generator, and a 125 to 150 hp direct connected engine of good make. It is proposed to reinforce all the main lines and to build a new one in the city. They have now from the station four No. 0 wires to the central part of the city. Other small changes are contemplated. Mr. H. B. McElroy is the superintendent and manager of the company.

BIDS FOR NAVY SUPPLIES.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, until Nov. 28, to furnish at the navy yards at Portsmouth, N. H.; Boston, Mass.; Newport, R. I.; New York, N. Y.; League Island, Pa.; Washington, D. C., and Norfolk, Va., arc lamps, wire, conduit, panel boards, electrical supplies, etc. H. T. B. Harris, Paymaster-General, U. S. N.

THE BROOKLYN HEIGHTS RAILWAY COMPANY has recently placed an order with the Westinghouse Electric & Manufacturing Company for a substantial addition to its present equipment, consisting of 300 No. 101-B Westinghouse direct current railway motors and 150 sets of controllers. The order for motors is in addition to one placed some months ago for 600 motors of the same type.

B. F. STURTEVANT COMPANY, Boston, Mass., reports sales of a new horizontal generating set to David Rogers Company, Paterson, N. J., and economizers to Singer Manufacturing Company, Elizabethport, N. J.; Springville Manufacturing Company, Rockville, Conn.; Nashua Manufacturing Company, Nashua, N. H., and American Woolen Company, Lawrence, Mass., etc.

O. C. WHITE FIXTURES.—The O. C. White Co., of Worcester, Mass., were visited by fire on October 25, and their whole factory was in danger for a time. Their stock suffered from smoke, etc., but all their machinery and tools were saved. They are now in a position to make shipments again of their well-known adjustable fixtures for incandescent lamps.

HEATING AND VENTILATING APPARATUS is being supplied by B. F. Sturtevant Company, Boston, Mass., for a large number of school buildings; also for the Hotel St. Regis, New York; Bantleon Bros., Rochester; Ætna Cotton Mills, Mixon, S. C.; Pennsylvania Railroad shops; H. S. Kerbaugh, Altoona, Pa.

ORDER FOR SIGNALS.—The Philadelphia & Reading Railroad Company has given an order for the equipment of about fifty miles of double track with the Hall normal danger automatic block signal system.

THE NATIONAL ELECTRIC COMPANY, of Milwaukee, has recently closed a contract with the Arbuckle-Ryan Company, of Toledo, O., for two 250-kw engine-type, alternating-current generators, for installation at Canton, O.

Financial Intelligence.

THE WEEK IN WALL STREET.—There was renewed reaction in the stock market as a result of higher rates for loans, although there was some support at the declines. At the close of the week the tone was steadier. The market was also unfavorably affected by the election in New York City, local franchise stocks showing some weakness as a result of the apparent strength of the municipal ownership vote. There was a break in Metropolitan Street Railway and an accompanying weakness in Brooklyn Rapid Transit and Consolidated Gas. The decline in Metropolitan was checked, however, by covering on the part of the large short interest which has been outstanding in that security for some time past. The United States Steel stocks sold off with the rest of the list, and this was also the case with the standard railroad stocks as a class. The electric securities, in common with the rest of the stocks, were down. Metropolitan Street Railway was the heaviest loser among the tractions for the reasons already stated. There was heavy selling of this stock at prices ranging between 125½ and 116, the closing quotation being 116⅛, representing a net loss of 5½ points. The sales aggregated 109,700 shares. This number was exceeded, however, by Brooklyn Rapid Transit, of which securities 198,500 shares were reported sold, but the price of this stock did not yield to the pressure to so great an extent. The closing quotation was 74¾, which is a net decline of 1¼ points. Interborough Rapid Transit (on the curb) dropped 1⅛ points, closing at 208⅞. Manhattan Elevated lost 2½ points, closing at 163½, a narrow business being recorded. Of the electrics the two issues of Allis-Chalmers, closed with fractional declines, common, ⅜ point, and preferred, ¾, the last quotations being 19 and 61¼, respectively. General Electric, on sales aggregating 3,600 shares, lost 1 point, closing at 185, and Westinghouse declined 4 points, the last quotation being 170. New York & New Jersey Telephone rights sold at prices between 13⅛ and 12⅞, closing at the lowest figure. Western Union is down as a fraction, the last quotation being 93, and American District Telegraph dropped 6 points, losing about all of its recent gains, the closing quotation being 37. The curb market showed evidence of a good deal of liquidation during the week, following the lead of the Stock Exchange list. Following are the closing quotations of Nov. 14:

NEW YORK

	Nov. 8	Nov. 14		Nov. 8	Nov. 14
Allis-Chalmers Co	19¼	20	General Electric	183	182
Allis-Chalmers Co. pfd	61	62⅜	Hudson River Tel	..	..
American Dist. Tel	40	37	Interborough Rap. Tran	210	207
American Locomotive	68⅛	67⅝	Mackay Cos	48⅝	48⅛
American Locomotive pfd	114	114	Mackay Cos. pfd	73	72
American Tel. & Cable	92	93	Marconi Tel	..	..
American Tel. & Tel	136	133	Metropolitan St. Ry	121	117¼
Brooklyn Rapid Transit	75⅜	76¼	N. Y. & N. J. Tel	..	..
Electric Boat	32	32	Western Union Tel	93	92⅞
Electric Boat pfd	70	70	Westinghouse com	171	175
Electric Vehicle	15	15	Westinghouse pfd	..	..
Electric Vehicle pfd	20	20			

BOSTON

	Nov. 8	Nov. 14		Nov. 8	Nov. 14
American Tel. & Tel	138¼	134	Mass. Elec. Ry. pfd	55⅛	56
Cumberland Telephone	122⅝	122⅛	Mexican Telephone	1⅜	1⅜
Edison Elec. Illum	246	245	New England Telephone	*136	134
General Electric	182	182	Western Tel. & Tel	13	13
Mass. Elec. Ry	13	13¼	Western Tel. & Tel. pfd	89½	89

PHILADELPHIA

	Nov. 8	Nov. 14		Nov. 8	Nov. 14
American Railways	52	53	Phila. Electric	9⅛	8⅝
Elec. Co. of America	11⅝	11⅝	Phila. Rapid Trans	27¾	26¼
Elec. Storage Battery	80	78	Phila. Traction	..	..
Elec. Storage Battery pfd	..	..			

CHICAGO

	Nov. 8	Nov. 14		Nov. 8	Nov. 14
Chicago City Ry	200	200	National Carbon	64	50
Chicago Edison	..	..	National Carbon pfd	114	115
Chicago Subway	..	..	Union Traction	..	..
Chicago Tel. Co	..	..	Union Traction pfd	..	..
Metropolitan Elev. com	28	28⅛			

* Asked.

TRANSFER OF PITTSBURG SYSTEMS.—It is stated that the United Gas Improvement Company has at last bought the Philadelphia Company. Incorporated as the Empire Contract Company in 1871, the Philadelphia Company was organized under its present name in 1884. The original purpose was to supply fuel gas, but operations long ago expanded into illuminating gas, electric light and electric surface transportation, and the company furnishes fuel and illuminating gas and electric light almost exclusively to a population of 700,000, including the cities of Pittsburg and Allegheny. The company has over 469 miles of street railway through ten street railway properties owned or controlled by it, these properties being operated by the Pittsburg Railway Company, whose stock is entirely owned by the Philadelphia Company. Six electric and gas illuminating companies are owned or controlled by lease by the Philadelphia Company, and it furnishes electric light, heat and power almost exclusively to the cities of Pittsburg and Allegheny and vicinity, while it controls the exclusive right to manufacture illuminating gas in these two cities. The company has almost a monopoly of the supply of natural gas in the same territories in which it operates its electric light and illuminating gas by its ownership and control of a number of gas companies. About 319,764 acres of gas territory in Pennsylvania and West Virginia are controlled by lease, which are reported to be good for from twenty-five to thirty years.

CUMBERLAND TELEPHONE.—The Cumberland Telephone & Telegraph Company has been showing very good earnings. In fact, the yellow fever epidemic has not been an adverse factor at all, for the reason that when people cannot travel they telephone. During the first nine months of the current fiscal year gross earnings have increased $449,683 and net have increased $112,110. The heavy increase in expenses for the first nine months of the current year was due to the fact that quite large sums have been spent on works of improvement because the Cumberland has in the past maintained its equipment on a pretty fair level. The expense item has increased so far this year to the extent of $337,573 and has eaten up about 62 per cent of gross. The surplus for the nine months after the payment of charges stands at $1,089,589, which is considerably in excess of the dividend requirements for the whole year. The dividend disbursements this year will be somewhat larger than that for 1904, because a new issue of stock to the amount of $1,745,300 was made in February of this year, bringing the total outstanding stock up to $13,449,650.

THE STANISLAUS ELECTRIC POWER COMPANY. has been organized at San Francisco, Cal., with a capital of $10,000,000. The financiers of the new corporation are Tucker, Anthony & Company, of Boston, and the Knickerbocker Trust Company, of New York. Beach Thompson, of San Francisco, was the organizer of the company, and Leopold Wallach, of New York, interested Eastern capital in the enterprise. Both Leopold Wallach and Leopold Michels, president of the San Francisco Coke & Gas Association of this city, are heavily interested in the new power company. The company has been organized to furnish the city with electric power, and probably will be closely allied with the San Francisco Coke & Gas Company. It is understood work has already been commenced on the middle fork of the Stanislaus River. The plans of the company call for 30,000 e.h.p., and, in addition to that, water power equivalent to 20,000 hp.

MASSACHUSETTS ELECTRIC GOLD NOTES.—A syndicate, headed by the Old Colony Trust Company, has purchased a block of $3,500,000 4½ per cent five-year gold notes of the Massachusetts Electric Companies. These notes were authorized at the annual meeting last July, and replace a like amount of notes, of which $2,700,000 were outstanding. Of the new issue, $2,700,000 will be used to retire the $2,700,000 of notes now out and which mature Jan. 1, and the remaining $800,000 notes will be issued and the money invested in the notes of the controlled corporations. These notes are secured by shares of the Boston & Northern and Old Colony Street Railway companies. It is stated that these notes were syndicated at 96½ and are being offered to the public at 98.

JERSEY FINANCIAL LITIGATION.—By consent of all counsel, Chancellor Magie in the Court of Chancery dismissed the suit brought by Adam H. Groel, of Newark, against the United Electric Company of New Jersey and the United Gas Improvement Company of Philadelphia for the return of $20,000,000 par value of the stock of the United Electric Company, or of its value, alleged to be at least $6,000,000, and claimed to have been appropriated without consideration by the United Gas Improvement Company at the time it promoted and caused the formation of the United Electric Company, now absorbed by the Public Service Corporation.

BONUS TO THE PUBLIC.—In connection with the recent statement of Milwaukee Electric earnings, General Manager John I. Beggs writes us: "Our receipts have been reduced about $1.100 per day (which must all come out of net), owing to the fact that on Jan. 1 last we began honoring commutation tickets—25 for $1 and 6 for 25 cents—all day long; whereas for five years before that date tickets had only been good during two hours in the morning and 1½ hours in the evening. The increased use of tickets has averaged from 110,000 to 120,000 daily, about 80 per cent of our riding now being on tickets."

DIVIDENDS.—The American Railway directors have declared the regular quarterly dividend of 1½ per cent, payable December 15, to stock of record, November 29. The regular quarterly dividend of the American Telegraph & Cable Company of 1¼ per cent is payable on December 1. The directors of the Columbus Railway Company have declared the regular 1¼ per cent. quarterly dividend on the common stock, payable December 1.

CINCINNATI TROLLEY BONDS.—The capital stock of the Cincinnati, Milford & Loveland Traction Company will shortly be increased $650,000, the new stock to be 5 per cent cumulative preferred. The new stock will be issued to take up a bond issue of the same amount and bearing the same rate of interest.

General News of the Week

The Telephone.

SAN DIEGO, CAL.—The Sunset Telephone Company is preparing to put up about 145 miles of new extensions. The direct line from here to Oceanside is one of the important links.

STAMFORD, CONN.—The Southern New England Telephone Company has purchased a lot of land in this city, on which it will erect a new building for its exchange. A new switchboard with a capacity of 3,000 lines will be installed.

COLQUITT, GA.—The Colquitt Telephone Company has been organized. Messrs. C. C. Bush, N. L. Stapleton, W. I. Geer, W. C. Dancer, J. S. Bush, E. D. Bush, Joe Tole, J M. Shingler, M. D. Roberts, J. L. Tabb and W. J. Ballard compose the local company.

BOISE, IDAHO.—Articles of incorporation have been filed for the Star Independent Telephone Company, with a capital stock of $10,000. The incorporators are: H. D. Anderson, J. S. Clark, L. B. Wehr, A. S. Bixby, S. S. Foote, A. W. Hall.

QUINCY, ILL.—The Quincy Automatic Telephone Company proposes to increase its capital stock from $15,000 to $1,000,000.

CHICAGO, ILL.—The Chicago Numerical Telephone Index Company has been formed with a capital of $50,000, by J. W. Arnet and E. C. Mapledoram.

SOPHERVILLE, ILL.—The Sopherville & Log City Telephone Company has been formed with a capital of $625, by James Pendergast and Charles J. Maxwell.

ELKHART, IND.—The Dunlap Telephone Company has been organized. Capital, $20,000. Incorporated by William D. Kauffman and Marion I. Pancake.

INDIANAPOLIS, IND.—Checks for the payment of the November dividend were mailed during the week by the Indianapolis Telephone Company to holders of stock in the New Telephone Company, lessee.

DES MOINES, IA.—The Brighton Mutual Telephone Company has been formed with a capital of $25,000.

EARLVILLE, IA.—The Interstate and the Delaware County Telephone Companies have consolidated their lines in this county, and hereafter the same central office will be used for both lines.

COUNCIL BLUFFS, IA.—Wickham Bros. and P. H. Wind have secured the contract to erect the new exchange building for the Independent Telephone Company. The cost will be $14,000.

MANCHESTER, IA.—The toll lines of the Interstate Telephone Company, extending from Dyersville to Hopkinton, Delhi, Delaware and Manchester, have been taken over by the Delaware County Telephone Company, of Manchester.

PADUCAH, KY.—The Independent Telephone Company has closed a deal for the acquirement of the independent lines at Benton and in Marshall county.

LANSING, MICH.—The Council has directed the Michigan State Telephone Company to place the wires under ground.

EMMETT, MICH.—The Michigan Telephone Company has awarded to ex-Representative Dunn the contract to build a telephone line from this city to Goodells.

GRAND RAPIDS, MICH.—The Common Council has passed a resolution which voids an old franchise granted some years ago to the American Telephone & Telegraph Company. This action was undoubtedly taken to forestall any of of the present companies from securing the old grant. It is claimed that the franchises of the companies now doing business in this city have expired and the Common Council has declared its intention of forcing them to secure new grants.

ISHPEMING, MICH.—Articles of incorporation of the Home Telephone Company, a new independent concern, have been filed with the secretary of state. The promoters are identified with the new United States Independent Telephone Company. The new company proposes to build an exchange at Detroit as soon as it is practicable to do so, the system there costing perhaps $5,000,000, and it also plans to build trunk lines in other portions of the State, including the upper peninsula.

ERSKINE, MINN.—A. F. Cronquist has purchased the Erskine telephone system and will extend and improve it.

EAST GRAND FORKS, MINN.—The election resulted in favor of granting a franchise to the Tri-State Telephone Company.

BIGELOW, MINN.—Wm. Widman and others are interested in the proposed construction of a telephone exchange at this place.

MINNEAPOLIS, MINN.—The Minnesota Central Telephone Company will at once commence the construction of an additional copper line from Minneapolis to Granite Falls, the one built last fall being found inadequate for the amount of business now handled from and through this exchange.

CARTHAGE, MO.—The Missouri & Kansas Telephone Company has purchased the property and business of the Southwest Telephone Company, known as the Peel lines. The purchased lines includes extensive toll lines over parts of Barry, McDonald, Newton, Jasper and Greene counties and over all parts of Lawrence county. It also includes the telephone exchanges at Peirce City, Monett, Aurora, Stotts City, Bowers Mills, etc., and means the accession of a large amount of business to the company making the purchase.

GOLDFIELD, NEV.—The Southern Nevada Consolidated Telegraph & Telephone Company, it is stated, will immediately construct a new building here, which is to be the headquarters of the company. An office building will also be built.

HORNELLSVILLE, N. Y.—The New York & Pennsylvania Telephone & Telegram Company will soon commence the erection of a new building in this city.

WALTON, N. Y.—The Pine Telephone Company of Walton has been incorporated with a capital stock of $15,000. The directors are I. L. Brayman, Vernie Francisco and C. W. Murray.

WEATHERFORD, OKLA.—The Farmers' Mutual Telephone Company has been formed with a capital of $2,500, by R. X. Ward and J. T. Bradley.

MULHALL, OKLA.—The Mulhall Rural Telephone Company has been formed. Capital, $5,000. Incorporated by C. E. Hudropete and W. M. Peters.

WATONGA, OKLA.—The Watonga Telephone Company has been organized with a capital stock of $25,000. Incorporated by George Massey and George A. McArthur.

CADIZ, OHIO.—The Harrison County Telephone Company certifies to an increase of capital stock from $50,000 to $100,000.

COSHOCTON, OHIO.—James S. Brailey, jr., of Toledo, has purchased the controlling stock in the Tuscarawas County Telephone Company.

BOWLING GREEN, OHIO.—The Wood County Telephone Company by a deal completed a few days ago has absorbed the Home Telephone Company at North Baltimore. The North Baltimore plant will be continued under the same name, The Home Telephone Company, but will be owned and controlled by the Wood County Telephone Company.

NEW WILMINGTON, PA.—The New Wilmington Telephone Company has been organized by J. M. Houston and Wm. A. Thompson and others, and they are finishing the erection of a local telephone system at New Wilmington. They have signed a 3-year contract to connect with the Union Telephone Company's long-distance lines, and will have connections with local systems in Lawrence County, Pa.

BONESTEEL, S. D.—The Nebraska Interstate Telephone Company and the Gregory Home Telephone Company have been merged and will make extensive improvements and additions.

SHAMROCK, TEX.—The Walker Telephone Company has been formed; capital, $10,000.

CAMERON, TEX.—The Southwestern Telephone Company will improve its system and service in this place.

BEAUMONT, TEX.—C. C. Conroy, president of the Beaumont Northwestern Telephone Company, says that he will institute proceedings in court to recover possession of the property of that company from Receiver J. W. Mackey. The Beaumont Northwestern Telephone Company's property consists of 16 exchanges in East Texas and more than 500 miles of wire. It was under lease to the Lone Star Telephone Company at the time it was placed in the hands of a receiver. Mr. Conroy says that if he recovers possession of the property important improvements and extensions of the system will be made.

DALLAS, TEX.—At a meeting of the members of the Texas Independent Telephone Association, held at Dallas on Nov. 7 and 8, steps were taken to establish a clearing house for the purpose of handling all of the business of the independent telephone companies in the State and to provide for toll charges to apply to all messages on the independent toll lines. The following officers of the clearing house were elected: President, Cecil L. Simpson, of Dallas; vice-president, E. P. Butler, of Gainesville; secretary and treasurer, E. W. Dunaway, of Paris. It was decided to hold the next meeting at Waco at such time as the executive committee shall decide to call it.

RICHMOND, VA.—The Petersburg Telephone Company has awarded the contract for a new building in this city, to cost about $10,000.

CATHLAMET, WASH.—The North Shore Telephone Company will construct a line to connect with the Sunset cable at McGowan and extend east to Cathlamet, Gray's River, Deep River, Skamokawa, Knappton, Frankfort and intervening points touched by the system. Brix Bros. are interested in the project.

PRENTICE, WIS.—A local company is projected to install an automatic telephone exchange.

EDGAR, WIS.—The Edgar-Cassel-Emmett Telephone Company has been organized. The capital is $1,500. Incorporated by E. C. Barrett and Otto Fehlhaber.

RANDOM LAKE, WIS.—The Random Lake Telephone Company, of Sheboygan county, has been formed; capital stock, $5,000. The incorporators are T. E. Malloy, T. D. Schmidler and W. B. Krause.

KENOSHA, WIS.—The business of the two telephone exchanges in Kenosha has been merged, but no changes were made in the management of either. By the merger the Wisconsin company retires from the Kenosha field and the entire telephone business is turned over to an independent company.

RAWLINS, WYO.—The Bell Telephone Company for Wyoming announces that it will reconstruct the telephone systems in Cheyenne, Laramie, Rawlins and Sheridan.

VANCOUVER, B. C.—The Western Union Telegraph & Cable Company has decided to lay another cable from the mainland to Victoria, at a cost of $25,000.

CITY OF MEXICO, MEX.—The Mexican Telephone & Telegraph Company has resumed the work of laying its underground telephone system, under the direction of W. B. Hale, its new general manager. When the underground system is further advanced the work will be commenced of taking down the overhead wires within the portions of the city for which the company holds a concession to put down its conduit system. The company expects to have the work of improvement completed by the middle of next May. The new switchboard has been ordered from Chicago.

Electric Light and Power.

ABBEVILLE, ALA.—The citizens are discussing the question of constructing an electric light plant.

FORT PAYNE, ALA.—The Alabama Cooperage Company, of Fort Payne, has petitioned Council for a franchise to construct an electric light plant to furnish light for the streets, residences and business houses.

LOMPOC, CAL.—J. M. Stamp has petitioned for a franchise for an electric light plant.

LOS ANGELES, CAL.—The Los Angeles Gas & Electric Company has secured the contract for lighting the city for 3 years. The total amount of the contract is about $500,000.

OROVILLE, CAL.—The Oro Water, Light & Power Company, of Oroville, has completed the contracts for the equipment of its electric transmission plant at Pentz by ordering two "double overhung" Pelton impulse wheel units. A 1,000-hp. wheel is placed at each end of a shaft, with a 1,000-kw. General Electric 3-phase railway-type generator in the middle. There are two of these units to be operated under a head of 465 ft., transmitting power 16 miles to Oroville, where city lighting and power for operating gold dredges will be supplied. There is an ample water supply from the Feather River Canyon.

PALO ALTO, CAL.—Measures will be taken by the Board of Town Trustees of Palo Alto to prevent the Redwood City Electric Light & Power Company from operating there without a franchise. Since electric light and power was first supplied to Palo Alto the Redwood City concern had no opposition until the municipal plant was installed. The question then arose whether a franchise was necessary for the private corporation. Threats of rate-cutting have had no effect on the trustees. At a conference the proposition to purchase the works and plant by the trustees for Palo Alto was rejected. Of the several plans suggested none was accepted as favorable to the municipality. The officials of the Redwood company refused to turn over the Palo Alto branch of their plant, asserting that a franchise is no more necessary now than it was when they first entered this territory.

SAN FRANCISCO, CAL.—The Santa Cruz Portland Cement Company has closed a contract with the Westinghouse Electric & Manufacturing Company for 28 induction motors for the new cement mill in course of construction at Davenport, Santa Cruz county, Cal. The largest motor will be of 850 horse-power and there will be ten 200-hp. motors. The combined capacity of all the motors is 5,600 horse-power. The same owners have two 800-hp. Westinghouse induction motors operating the cement mill at Napa Junction giving satisfaction, but it was thought advisable to subdivide the power units more for the new plant, which is larger, having a daily capacity of about 5,000 barrels of cement. A 40-mile pole line is being constructed to the works by the California Gas & Electric Corporation, which has a contract to supply the electric power. The Allis-Chalmers Company has the contract for all of the cement machinery, amounting to 50 car loads, and shipments have commenced.

STONINGTON, CONN.—Fort Mansfield at Napatree point is to have electric lights and electrical connections for other purposes. Connections will be made with the Westerly Company's wires from which power will be taken until the government establishes a plant at the reservation.

RIDGEFIELD, CONN.—The plans for the plant of the Ridgefield Electric Light Company have been approved and contracts will soon be let for the work.

JACKSONVILLE, FLA.—The Allis-Chalmers Company, of Milwaukee, Wis., has secured the contract for two 500-kw. turbo generators with necessary equipment for $36,135.

ASHBURN, GA.—The question of constructing an electric light plant and water works is under consideration here. J. B. McCrary, of Senoia, is engineer.

ATLANTA, GA.—An interesting fight has ben started in Atlanta by the Southern Power & Lighting Company to gain a footing in this city. The first move was made at a recent meeting of the Council when the Atlanta Telephone Company applied for a franchise to lay conduits in the streets. A representative of the telephone interests stated that it was desired to have the right to place any kind of electric wires in the conduits and that the Southern Company could make terms with Council when occasion might arise.

ATLANTA, GA.—According to a quoted statement of Forest Adair, vice-president of the Atlanta Water & Electric Power Company, there can be no reopening of the question of the franchise of the company with the State, Mr. Adair claiming that the matter has been settled by arbitrators and that the proposed reopening of the matter by submission to another board is without precedent, as far as he knows. The state comptroller will however insist upon the collection of taxes on a valuation of nearly half a million dollars.

MONMOUTH, ILL.—The Monmouth Gas & Electric Company has completed plans for an electric light plant.

STREATOR, ILL.—The People's Light & Railway Company and the Streator Gas & Light Company have combined, the light and railway company being the purchaser. The latter corporation is capitalized at $400,000.

PERU, KAN.—W. R. Murrow, proprietor of the electric light and power plant, has gone to Cherryvale to make preparations to install a plant there. He has a franchise from the city.

LA HARPE, KAN.—S. A. Gard, of Iola, Kan., has made a proposition here to the City Council to light the town. Wm. Turner, of this place, has also made a similar proposal. The plan of the latter is to operate the light plant in conjunction with the ice plant.

PADUCAH, KY.—The Paducah Light & Power Company has been incorporated, with a capital of $450,000.

WINCHESTER, MASS.—The Edison Electric Illuminating Company has lately taken over the business of lighting the streets and houses of Winchester, which service was formerly performed by the Woburn Light, Heat & Power Company.

PALMER, MASS.—The town of Wilbraham is now supplied with electric light from the plant in this city. The Palmer plant is now furnishing a lighting service to the towns of Palmer, Warren, West Warren, Monson and Wilbraham.

PALMER, MASS.—The Central Massachusetts Electric Company has decided to extend its business to Bondsville for commercial use in that village. It will be necessary to run four miles of wire and the work will start in a short time. It is expected to have it completed by Jan. 1.

BALTIMORE, MD.—Bids will be received until Nov. 22 by the Board of Awards for furnishing for the use of the Electrical Commission about 1,000,000 duct-ft. of conduit material, and $100,000 ft. of special duct pipe. For further information apply to Chas. E. Phelps, jr., chief engineer electrical commission.

ELK RAPIDS, MICH.—The Elk Rapids Light & Power Company has been incorporated with a capital stock of $25,000.

JACKSON, MICH.—Electric search lights have been placed on the walls and top of the main building of the State's prison, located here.

IRON RIVER, MICH.—The citizens have voted to issue $30,000 bonds for constructing an electric light plant and for the rebuilding of the water works.

MORRICE, MICH.—The electric lighting plant owned by Sutton & McKay has been sold to John Hubert, of Lansing, and Edward Hubert, of Farmington.

WOODMERE, MICH.—The Edison Lighting Company, of Delray, is preparing to construct a plant in Woodmere, to supply the village with electric light.

LANSING, MICH.—The receipts of the municipal lighting plant are showing a gain of more than $1,000 a month, compared with the figures for corresponding periods last year.

JACKSON, MICH.—The factory building of Withington & Cooley, which was destroyed by fire, has been rebuilt and nine electric motors will replace the 350-hp. engine which formerly furnished the power.

GRAND RAPIDS, MICH.—The Grand Rapids-Muskegon Electric Water Power Company expects to deliver power in this city and Muskegon by Feb. 1. The contract for a concrete sub-station in this city has been let.

LANSING, MICH.—W. L. Haag, of Haag Bros., is seeking a franchise to furnish power and heat within the city. The firm generates electric power at its mill at the head of the North Lansing mill race. The heating privilege is asked for in anticipation of the perfection of electrical heating apparatus.

CANNON FALLS, MINN.—The Cannon River Electric Power Company has purchased the plant of the Northfield Light, Heat & Power Company. Power for the plant at Northfield, and also the local plant will eventually be transmitted from the dam to be built across Cannon River, one mile west of the falls.

SEDALIA, MO.—In accordance with a resolution recently passed by the Sedalia City Council, suits were filed, Nov. 7, against the Sedalia Water and Light Company, and the Sedalia Light and Power Company, to forfeit their charters. The petitions allege that both companies have failed to comply with the conditions, and have failed to furnish light and power for city and commercial purposes. A similar suit was recently filed against the Sedalia Gas Company.

BUFFALO, N. Y.—At the election Nov. 7 the citizens voted in favor of a municipal lighting plant.

WATERFORD, N. Y.—The village trustees directed the Light Committee, president, attorney and engineer, to ascertain the cost of constructing and operating an electric light plant.

LOCKPORT, N. Y.—Electric power from the Ontario Power Company's plant at Niagara Falls is now being received in this city. The gas and electric light company is utilizing the power, which is transmitted at 12,000 volts.

OSWEGO, N. Y.—The Citizens' Lighting Company has been incorporated with a capital stock of $75,000 by J. C. Knight, Thomas Moore and C. A. Bentley, of Oswego.

NEW YORK, N. Y.—Bids will be received until Nov. 20 by Maj. G. S. Bingham, Q. M., U. S. A., 39 Whitehall Street, for furnishing and delivering f. o. b. factory about 55,000 incandescent electric lamps.

LENOIR, N. C.—The Citizens Light & Power Company, of Lenoir, has been incorporated with a capital of $25,000. The incorporators are H. F. Newland and W. B. Ivey.

YADKIN COLLEGE, N. C.—The Yadkin Development Company has been formed by Dock Hartley, of Yadkin College; Prof. J. M. Bandy, of Greensboro, and others, to develop water power for electrical purposes in Davidson county. It is proposed to construct a canal 11 miles in length from a point on Yadkin River, at Yadkin College, to a point near Linwood.

NEWPORT, N. H.—The Sunapee Electric Light & Power Company, which is now owned by the Newport Electric Light Company, has just completed the work of rebuilding its lines. A 24-hour service will now be given.

NEW MARKET, N. H.—W. H. C. Follensby, of Exeter, has been appointed receiver of the Newmarket Electric Light, Heating & Power Company by Judge Stone. The appointment was in answer to the petition of the minority stockholders of the company, which alleged that the affairs of the company were being mismanged by President J. W. Burnham, of Durham, who was the majority stockholder, and that the company was insolvent. Further, that $15,000 of the bonds of the company had been fraudulently issued by the president, and asking that W. E. Barrett, of Boston, president of the Union Trust Company, be asked to explain how he had come into possession of the bonds, which the latter did. Mr. Follensby has furnished $5,000 bonds.

FOREST, OHIO.—The Town Council has decided to construct an electric light plant.

HAINES, ORE.—J. F. O'Bryant has secured a franchise to construct an electric light plant.

LA GRANDE, ORE.—The Grand Ronde Light & Power Company has completed its connections with Morgan Lake and the new plant is now in operation.

EUGENE, ORE.—W. T. Campbell, of Eugene, and associates are said to be considering the construction of a power plant on McKenzie River in the vicinity of Walterville, for the purpose of generating power for electrical purposes.

EUGENE, ORE.—The City Council has employed Engineer Kelsey, of Salt Lake City, Utah, to make surveys, plans and estimates, for the proposed municipal electric light plant and water works, for which the citizens have voted to issue $200,000 bonds. The site for the power plant is reported to have been selected on McKenzie River, about 30 miles east of Eugene.

OREGON CITY, ORE.—H. W. Hageman, of Stone City, Ore., has completed financial arrangements for the construction of an electric light and power plant on Clackamas river, about 7 miles above Oregon City. He will build a 35-ft. dam and construct a large power plant. It is proposed to furnish light and power to Park Place, Gladstone, Clackamas Heights, Oregon City and Portland.

PORTLAND, ORE.—Machinery costing $165,000 for the Oregon Water Power & Railway Company is being delivered. The company is constructing a dam in the Clackamas River, at Cazadero, 37 miles from Portland, and will install a plant to develop 20,000 horse-power. President, W. H. Hurlburt officially announces that the plant will be completed and in operation before the end of next summer. The total cost will be $225,000. The Bullock Company, of Cincinnati, has the order for generators. The Stanley Company, of Pittsfield, Mass., is manufacturing the transformers. The water wheels come from the Pratt Iron Works, Dayton, Ohio. The power to be generated will be used in operating 100 miles of electric railway between Portland and Cazadero and branch lines in and about this city, also the electrically lighted pleasure park, "The Oaks." There will be a large surplus of power, and this will be delivered under a contract to the Portland General Electric, to be used in commercial lighting and power in this city.

GEARY, O. T.—The Geary Electric Light & Power Company has been incorporated with $5,000 capital stock by Charles F. Dyer and I. J. and J. M. Romm.

BENTON, PA.—Definite steps have at last been taken towards bringing the Benton electric light plant into reality. The company has engaged W. O. De Witt of this town as consulting engineer, and he will at once prepare plans and specifications for the erection of the power house.

LAWRENCEBURG, TENN.—Jas. Dunn, city secretary-treasurer, writes that it is proposed to construct water works and an electric light plant, at a cost of about $25,000. No engineer has been employed as yet.

CHATTANOOGA, TENN.—A 20-year exclusive franchise is for sale for a water and an electric light and power system, including rights of way, etc. For further information address I. L. Faucett, Chamberlain Building, Chattanooga.

MEMPHIS, TENN.—The Boardman Electric Company has filed an application for an amendment to its charter in order to change the name of the company to the Bluff City Electric Company. The incorporators are: H. H. Carson, R. M. Ellet, G. B. Thornton, jr., and H. B. Hart.

VAN BUREN, TEX.—A deed has been filed here transferring the Van Buren electric light and power plant to the Fort Smith-Van Buren Bridge & Traction Company.

DUBLIN, TEX.—The Dublin Gas & Electric Company has been incorporated with a capital stock of $50,000 by J. F. Strickland, Oscar Godwin, of Dallas; M. B. Templeton, of Waxahachie; R. B. Sticher, of Sherman, and J. R. St. Clair, of Dublin.

SALT LAKE CITY, UTAH.—Francis M. Lyman, jr., has filed an application with the county commissioners for a franchise to erect poles and string wires along the county highways. He owns water rights on Mill Creek and proposes to construct a power plant.

HEBER, UTAH.—In addition to establishing an irrigation system to supply the settlers of Blue Bench on the Uintah reservation, the Blue Bench Co-Operative Water Company also proposes furnishing electric light and power, and has filed application with the state engineer at Salt Lake City for 200 second-feet of water from Rock Creek, in Wasatch county, which it proposes to develop. The diverting canal will be 36,500 ft. long.

OAKESDALE, WASH.—Mr. Shields, of Moscow, Idaho, is interested in the construction of an electric light plant at this place.

PORT ANGELES, WASH.—Mr. W. S. Hoskins, of Seattle, has made a proposition to take over the present electric light plant here, upon a 20-year lease, for the purpose of superseding the city in the lighting business.

FRESNILLO, MEX.—Regaciano Felguenes, a wealthy haciendado of the State of Zacatecas, is at the head of the company which is installing a new electric light and power plant at Fresnillo.

ZACATLAN, MEX.—Luis Gomez Daza and Joaquin Pita will install an electric power plant in the Zacatlan district. They have obtained a concession from the federal government for the purpose.

VERA CRUZ, MEX.—La Electrica is the name of a company which has been organized at Vera Cruz for the purpose of providing light and power for private consumers, factories and other industries. The company will install a large electric light and power plant.

GALEANA, MEX.—The federal government has granted a concession to Canuto Reyes, or any company he may organize, to install an electric power plant on the Atoyac River, near Galeana. The electrical energy will be transmitted to towns and mining camps of that section.

BATOPILAS, MEX.—It is stated that the Batopilas Mining Company will install an electric power plant near Batopilas. The company has obtained a concession from the federal government to use the waters of the Santa Gertrudes arroyo for the purpose of operating the plant.

CITY OF MEXICO, MEX.—La Compania de las Fabricas de Papel de San Rafael y Anexas, which recently increased its capital stock from $5,000,000 to $7,000,000, will make a large addition to its electric power plant on the Ixtechuatl River, near the City of Mexico. A dam will be built for the purpose of storing the water for power purposes.

PARRAL, MEX.—It is announced that the American company, of which Eugene Davis is at the head, has made all necessary financial arrangements for the construction of a large electrical power plant which is intended to supply the Parral mining district with power and electric lights. The initial power plant which is to be installed at Zona will consist of 3,000 horse-power in six units of 500 horse-power each.

ZACATECAS, MEX.—It is announced that the Compania Electrica de Zacatecas, which was organized for the purpose of installing an electric light and power plant in the city of Zacatecas, has awarded the contract for the entire installation to the Schoendube & Neugebauer Company, of the City of Mexico. The electrical machinery and equipment will be manufactured by the Allgemeine Electrical Company, of Berlin, Germany. The plant will be equipped with gas engines of about 200 horse-power each, to be built by the Koerting Works, of Hanover. The power house will be located about a mile from the center of the city.

EL DUERO, MEX.—The Guanajuato Electric Light & Power Company is installing additional machinery and motors at its hydro-electric plant at El Duero. The capacity of the plant will be doubled when the installation of the new equipment is completed. The plant now has a capacity of 10,000 horse-power. The company is supplying current to the cities of Leon, Irapuato, Guanajuato and La Barca, as well as to the mining camps throughout the district. Practically all of the 10,000 additional horse-power has been contracted for by mines and mills in the Guanajuato district. The cheap power is causing great activity in mining operations.

HALIFAX, N. S.—The question of constructing a municipal electric light plant is now being investigated. L. Fred. Monaghan is city clerk.

The Electric Railway.

MONTGOMERY, ALA.—The Alabama Railroad Commission has set a precedent by citing the Birmingham Railway, Light & Power Company to appear before that tribunal and show cause why it should not submit tariffs for approval.

LOS ANGELES, CAL.—The San Bernardino Valley Traction Company announces its intention of building a double track, connecting San Bernardino with Riverside. A. C. Denman, Jr., is now general manager of the company, in place of J. H. Fisher, Jr., resigned.

SAN FRANCISCO, CAL.—The California Midland Railway Company, which has been incorporated, with San Francisco as the principal place of business, will construct the projected electric railway system connecting Grass Valley, Auburn and Marysville. The capital stock of the new company is $3,000,000, of which $70,000 has been subscribed by John Martin, Eugene J. de Sabla, Leo H. Sussman, John W. Pryor and Walter J. McLean.

KOKOMO, IND.—By the acquisition of the interurban line now building from Zanesville to New Philadelphia, the Randall Morgan syndicate will control an interurban route from this city to Cleveland.

JEFFERSONVILLE, IND.—The Louisville & Indianapolis Traction Company, which proposes to build from Jeffersonville to Seymour, to unite with the Indianapolis & Columbus into Indianapolis, has obtained franchises through Clark and Scott counties.

MARION, IND.—The Marion, Hartford City & Eastern Traction Company, which proposes to build from Marion to Hartford City, has elected directors as follows: J. L. Thompson, R. A. Brasher, Oscar Thompson, W. B. Dodds and F. R. Chandler. Mr. Thompson was elected president; Mr. Dodds, vice-president, and Mr. Brasher, secretary.

SIOUX CITY, IA.—An announcement has been made that the Sioux City & Ireton Interurban Railway Company will build its line from Sioux City to Ireton. It is proposed to issue $400,000 of 5½ per cent 20-year bonds. The plan is to eventually continue the line to Spirit Lake. Surveyors are now at work laying out the route.

WORCESTER, MASS.—Directors of the Worcester Consolidated Street Railway Company have approved plans for a substation at West Boylston. It is to cost $35,000 and will be equipped with machinery to cost $20,000.

BAY CITY, MICH.—The Detroit & Bay City Traction Company will be built from Bay City to Caro this year. The remainder of the road to Detroit will be completed before Oct. 1 of next year.

ST. JOSEPH, MICH.—Vice-President Smith of the Indiana Railway Company has announced that the right of way for the proposed extension of that line from South Bend, Ind., to this city, has been secured. This extension, when constructed, will complete an interurban line between Chicago and Pittsburg.

ALLEGAN, MICH.—Allegan County supervisors have asked that W. H. Patterson build and equip the proposed electric line between Kalamazoo and Grand Rapids, with branches to Allegan and Douglas, before they grant his application for rights to dam the Kalamazoo river below Allegan village. The supervisors ask that the line from Allegan to Douglas by way of Fennville be built, giving that city an outlet to the lake shore.

CARTHAGE, MO.—The sum of $200,000 has been raised for the purpose of building an electric railway between this city and points to the northwest. At the meeting it developed that the action is necessitated by the advent of a new electric railway fostered by the Southwest Missouri Electric Company, connecting Webb City and Joplin with three smaller towns which have heretofore been tributary to Carthage.

LYONS, N. Y.—An electric railway is projected from Lyons to Sodus Bay. Among those interested are Charles H. Betts, Edson W. Hamn and James D. Bashford.

NEW YORK, N. Y.—Electric service has begun on the Grand and Desbrosses Street line from Desbrosses Street to Broadway. The line will soon be in operation to Grand Street Ferry and the Williamsburg Bridge.

ALBANY, N. Y.—The Catskill Mountain & Mohawk Valley Railway Company has been incorporated, with a capital stock of $2,000,000, by Edward C. White, New York; George C. Kendall, Stamford; Herbert S. Lounsberry, Port Chester, and E. E. Billings, Gilboa. It proposes to build a line of railway from Cairo to Oneonta, with spurs to Stamford.

WINSTON, N. C.—The High Point & Winston Electric Interurban Railway has been granted a franchise. Its capital is $450,000. Officers have been elected as follows: J. H. Mills, of High Point, president; C. C. Yetter, of Bloomsburg, Pa., vice-president; Frank A. Chaplin, of Philadelphia, secretary and treasurer.

SALEM, ORE.—The Citizens Electric Light & Power Company, of this city, has an agent in the field arranging for the right of way for the proposed electric railway between this city and Portland.

UNIONTOWN, PA.—The Uniontown and Waynesburg Street Railway Company has been formed. Capital, $120,000. Incorporated by J. V. Thompson and Geo. L. Hibs.

HOUSTON, TEX.—The Houston Electric Company has perfected plans for important extensions of its electric railway lines in Houston, and for other improvements. This system is owned by Messrs. Stone & Webster, of Boston, Mass.

GAINESVILLE, TEX.—John C. King, of Gainesville, vice-president of the Gainesville-Whitesboro-Sherman Interurban Electric Railway, announces that the contract has been let for the construction of the road. The power house will be located at Gainesville.

WAXAHACHIE, TEX.—The City Council of Waxahachie has granted a 35-year franchise over the streets of the city to J. S. Daugherty and associates for the proposed interurban electric railway that is to run from Dallas to Waxahachie. The road will be about 35 miles long.

BUCKHANNON, W. VA.—W. E. Hildebrand, of Clarksburg, is interested in a plan to build an electric railway from this place to Clarksburg. Mr. Hildebrand says the intention is to build a trolley system from Pittsburg through West Virginia.

PARA, BRAZIL.—An extensive American electric traction and lighting system is about to be constructed in the city of Para, Brazil, the commercial center of the Amazon Valley.

NEW WESTMINSTER, B. C.—The British Columbia Electric Company will probably build a branch line from this city to the Fraser River saw mills, at an estimated cost of $35,000.

WINNIPEG, MAN. — A by-law is being prepared to enable the Winnipeg Electric Company to run Sunday cars. In return for the concession the company will do away with the double fare after 11 o'clock nights and will sell 8 tickets for 25 cents on Sundays, the regular day rate now being 6 tickets for 25 cents.

New Industrial Companies.

THE GENERAL COLLECTION COMPANY, of New York, has been incorporated with a capital stock of $10,000, by G. A. Howard, George Learned and P. W. Brown, New York.

THE ELECTRIC APPLIANCE COMPANY, of Chicago, with a capital stock of $60,000, has been granted permission to do business in Texas. Dallas is the Texas headquarters of the company.

THE AUTOMATIC FIRE PROTECTION COMPANY, of New York, has been incorporated with a capital stock of $5,000. The directors are R. L. McElroy, J. E. Shepard and A. F. Hatch, Chicago.

THE CARPENTER ELECTRIC BATTERY & LAMP COMPANY, of New York, has been incorporated with a capital stock of $10,000. The directors are E. S. Thomson, C. B. Waite and Lillias H. Waite, of New York.

THE TONOPAH ELECTROLYTIC GOLD AND SILVER REDUCTION COMPANY has been incorporated at Camden, N. J., with a capital stock of $100,000, by H. Gilbert Coyle, J. Shoch Summers and Wilfred B. Wolcott.

FAIRBANKS, MORSE & COMPANY, of New York, have been incorporated with a capital stock of $50,000, by E. M. Boughey, Chicago, G. H. Baker and Emil Ebann, New York, to conduct an electrical equipment business.

THE ACME ELECTRIC COMPANY has been organized in Knoxville, Tenn. The officers are: Henry M. Moses, president and general manager; Frank S. Mead, vice-president; R. K. Gibson, secretary; Lewis P. Self, treasurer; Hugh J. Henry, superintendent. The capital stock is $5,000.

MACOMB CONSTRUCTION COMPANY.—The Macomb Electric Construction Company has been formed at Macomb, Ill., to act as consulting and contracting engineers for electric light stations and plants, telephone exchanges, power systems, etc. It will also handle electric light and telephone supplies. The capital stock is $10,000. Mr. C. M. Erwin is president; Mr. D. P. Pennywitt, vice-president; Mr. W. I. Savidge, secretary and constructing manager, and Mr. S. E. Purdum, treasurer.

Legal.

WIRELESS LITIGATION.—An order granting a perpetual injunction against the De Forest Wireless Telegraph Company, the American De Forest Wireless Telegraph Company, Abraham White and Lee De Forest, in favor of the National Electric Signaling Company, has been signed by Judge Wheeler in the United States Circuit Court. The injunction has to do with three claims based upon the Signaling company's patent and restrains the De Forest Company from making, using or vending the barretter device technically described as "an improvement in receivers for electro-magnetic waves." The decision was quoted recently in these pages. The De Forest people say that the matter is of slight importance, as it relates to an old form of apparatus discarded by them some time since.

Obituary.

MR. BEAUCHAMP H. SMITH, second vice-president of the S. Morgan Smith Company, of York, Pa., died at his home in Los Angeles, on Nov. 1, at the age of 36 years. Mr. Smith went to Los Angeles about five years ago for the benefit of his health, since which time he has resided there, and hopes for a complete recovery were entertained.

MR. F. H. BETTS.—Mr. Frederic Henry Betts, one of the legal advisers of J. P. Morgan & Co., died in New York City on November 11. Mr. Betts was an authority on patent law and was counsel in famous patent cases for the Western Union Telegraph Company, American Bell Telephone Company and the Edison Electric Light Company. In 1872, and for sevral years thereafter, he was counsel for the State Insurance Department. He was born in Newburg in 1843 and was graduated from Yale in 1864. Two years later he was admitted to the bar from the Columbia Law School. From 1880 to 1885 he was a member of the Republican County Committee, and was prominent in various reform movements in this city. In 1882 he was a member of the Committee of Fifty, and in the following year was a member of the Citizens' Committee of One Hundred. In 1890 and 1891 he was a member of the People's Municipal League. Mr. Betts was always closely associated with Yale University, in which for several years he was a lecturer on patent law. He founded the Betts Prize in the Yale Law School, and was a vice-president of the Yale Alumni Society. He was a member of the Century, Metropolitan, Grolier, City and Tuxedo clubs, and was a vestryman in St. George's Church in this city. Mr. Betts married in 1869 Miss Louise Holbrook, a daughter of John F. Holbrook. His wife and three children—Louis F. H. Betts, Wyllys R. Betts and Mrs. Russell H. Hoadley—survive him.

Personal.

MR. ROBERT McF. DOBLE, consulting engineer of San Francisco, has severed his connection with the Abner Doble Company, in order to resume his individual practice, which requires all his time.

MR LOUIS J. MAGEE, the representing director in America of the Allgemeine Elektricitaats Gesellschaft, has just returned to New York from a long trip to Europe, a large part of the time being spent on the Continent.

MR. ROBERT J. CROUSE, JR., of the National Lamp Company, of Cleveland, has been visiting New York City and the Eastern States this week in connection with his ingenious propaganda for general electrical advertising.

MR. CLOYD MARSHALL has resigned his position as engineer in the power department of the Union Electric Light & Power Company, of St. Louis, and become connected with the American De Forest Wireless Telegraph Company at St. Louis.

MR. FRANK J. SPRAGUE is to contribute to *Scribners Magazine* an article on the future of electric power applied to great railroads. This will be one of a general series of articles on modern railway enterprises and the problems associated with them.

MR. W. H. PATCHELL, engineer in chief of the Charing Cross, West End & City Electricity Supply Company, London, sailed for home this week on the White Star liner "Baltic." He made a very thorough study of central station and power transmission practice in this country and Canada, visiting Chicago, Detroit, Niagara Falls, Montreal, Boston, etc.

MR. T. C. MARTIN has been appointed by President Blood as editor of Progress, to report to the 29th convention of the National Electric Light Association, next May or June. Mr. Martin has for the past three years made to the association comprehensive reports on the progress during each year in the various branches of the art in this country and abroad.

MR. DUDLEY FARRAND, head of the electric lighting department of the Public Service Corporation of New Jersey, has sustained an irreparable loss in the death of his little daughter, an only child, to whom father and mother were devotedly attached. In this terrible bereavement the warm sympathy of a host of friends will go out to one who has always been himself so kind and thoughtful for all his associates.

Trade Publications.

L. B. ALLEN COMPANY, INC., sole patentee and manufacturer of the Allen soldering paste, soldering stick, soldering salts, Liquiflux, etc., has issued a large series of attractive blotters. They are available to such of our readers as may wish to secure them and care to make an application.

ELECTRIC WATER PURIFIER.—The Electric Water Purifying & Filter Company, 25 Broad Street, New York, has issued a descriptive booklet dealing with a new electrolytic process for the purification of water applicable to the treatment of supplies for municipalities, commercial and industrial establishments, hotels, apartments, homes and all domestic uses.

LIGHTING SPECIALTIES.—The General Electric Company, Schenectady, N. Y., has recently issued flyer No. 2166, devoted to porcelain receptacles for moulding wiring. All live parts of each receptacle are covered by a one-piece porcelain cap held in place by two screws which serve to attach the receptacle to the moulding.

MECHANICAL MACHINISTS TOOLS.—Catalogue No. 107 of the Brown & Sharpe Manufacturing Company, Providence, R. I., is a 164-page publication illustrating, describing and giving complete price-lists of machinists' tools. It is stated that the tools described in this catalogue are made with the intention that they shall be the best in their respective classes.

MINING MACHINERY—Catalogue No. 127 of the Allis-Chalmers Company, Milwaukee, Wis., treats at great length of ore sampling machinery. Bul-

letin No. 1405 of the same company deals with portable rock crushing plants. Bulletin No. 1406 is devoted to forged steel balls for ball mills, while bulletin No. 1407 describes the Bennett's pouring spoon for use in copper converters.

INSTRUMENTS FOR ELECTRO-THERAPY.—E. B. Meyrowitz, 104 East Twenty-Third Street., New York, has issued a well-illustrated, 73-page catalogue devoted to dry cells, galvanic and faradic batteries, milammeters, volt limit selectors and current controllers employed in connection with constant and alternating currents for galvanism, faradism, cataphoresis and galvano cautery.

A RED CIRCULAR, in neat narrow form, issued by the Stromberg Carlson Telephone Mfg. Company, of Rochester, N. Y., has a view of their handsome private branch switchboard for 60 lamp-signal lines and 10 trunks, and shows a variety of sub-station apparatus for use in connection therewith. Several testimonials are quoted.

GASOLINE ENGINES FOR SMALL POWER.—Bulletin No. 1 of the Olds Gasoline Engine Works, Lansing, Mich., deals with the constructional features and operating characteristics of type "A" gasoline engines for small power. A complete description is given of every detail of the engines. These engines are constructed in sizes from 2 to 7 horse-power, and are suitable for all kinds of work where small power is required.

TRANSFORMERS FOR THAWING WATER PIPES.—The Pittsburg Transformer Company, Pittsburg, Pa., has issued a special publication to show the practicability of thawing frozen pipes by means of electricity, to show that it is exceedingly profitable to do so, and also to call attention to its 1906 thawing outfit. Twenty-one testimonial letters are offered as evidence that the thawing outfits which have been used have given entire satisfaction.

MACHINE TOOLS.—The November issue of the *Progress Reporter* of the Niles-Bement-Pond Company, 111 Broadway, New York, describes numerous special machine tools, and illustrates several methods of mounting electric motors for direct driving. An interesting feature of a plate planer, which is shown, resides in the use of pneumatic clutches, which are stated to have proved very satisfactory for this work. Several views are given of Niles electric hoists and traveling cranes.

NEW YORK EDISON COMPANY has recently adopted some very neat and attractive stationery for its canvassing and follow up literature in different branches. The headings are printed in color and exemplify electric heating, cooking, motor service, printing, etc. The letter and sheet on signs has a neat vignette pasted picture in the upper left hand corner. A new head has Father Knickerbocker looking through a microscope at a small bill for current, rendered under the new reduced scale.

THE AMERICAN ARC LAMP COMPANY, of Kalamazoo, Mich., has issued a little folder talking about the use of enclosed arc lamps in department stores, offices, etc. It shows two illustrations, one of the brass and the other of the copper cover with which the lamp is provided when desired. The lamp is of the direct-current type for either 110 or 220 volts enclosed arc, with long life. One of the illustrations shows the immediate accessibility of the parts of the lamp opening completely without the use of tools.

DIRECT-CURRENT MEASURING INSTRUMENTS.—The Simplex Company, 60 Nassau Street, Newark, N. J., has just issued an illustrated catalogue dealing with direct-current measuring instruments. The moving system of these instruments consists of a flat rectangular coil wound on a damping frame, supported above and below by straight conducting bands. The magnetic system involves a horse-shoe permanent magnet having four flat, soft-iron pole pieces and a flat disc soft-iron core. Switchboard instruments are assembled in cast-iron cases, while the portable instruments are mounted in finely finished carrying cases.

"PROFITABLE ADVERTISING," always a valuable medium and monitor for the advertiser and the advertising public, has just issued an unusually valuable number. It is called the "international edition," and its hundreds of handsomely printed pages are full of most interesting data as to the personnel, history, circulation, influence and range of the famous newspapers and journals of Europe. Facsimile pages, portraits, sample "ads," etc., abound, and the issue is a mine of real information. Miss Kate Griswold, the publisher of this admirable Boston periodical, is to be heartily congratulated on the success of this "European trip."

News of the Trade.

THE SCOTT ELECTRIC LIGHT COMPANY will build a large plant in New Brunswick, N. J., to manufacture an improved electric arc lamp.

CASON & BARRETT, the consulting engineers, have removed their offices in Kansas City, Mo., to Suite 608-9-10, Heist Building, in that city, where they have secured much larger quarters for their electrical and mechanical engineering business.

LAMP GUARD FACTORY.—The Attleboro Electric Manufacturing Company, Attleboro, Mass., has opened a new shop for the manufacture of incandescent lamp guards. The firm has purchased the business and plant of the Greenwood & Daggett Company, of Boston. This firm manufactured guards until last July.

THE BAINBRIDGE-DURBIN ELECTRIC COMPANY has succeeded Burke & Whittle in the electrical construction business, which the latter concern has carried on at 26 N. 7th Street, Philadelphia. The new company will continue business at the same place. Mr. A. E. Bainbridge of the new company will continue manufacturing telephones as in the past.

FAN MOTORS.—The Westinghouse Electric & Manufacturing Company will have a new line of ceiling and floor column fan motors on the market the coming season, both direct and alternating current. These fans will have four blades and ball bearings, and be finished in black enamel and oxidized copper. The alternating current fans will be of the induction type and the direct current fans will be furnished with three-point switches. The regular line of alternating and direct-current desk and wall bracket fans will be as complete as requirements demand, and the current consumption the lowest ever known for fans of these types.

DE LA VERGNE MACHINE COMPANY.—Owing to the rapidly increasing Southern business of the past year the De La Vergne Machine Company, of New York, has established a branch agency at Atlanta, Ga. This agency is to cover the States of North Carolina, South Carolina, Alabama, Florida and Georgia, and will handle business connected with the three lines of machinery manufactured by the De La Vergne Machine Company, viz., refrigerating and ice making machinery, "Hornsby-Akroyd" oil engines and Koerting gas engines. Their representative will be Mr. W. M. Hargreaves, and the office will be located at 510 Chandler Building.

ELECTRIC TESTING LABORATORIES.—In response to the demands of its clients the Electrical Testing Laboratories, Eightieth Street and East End Avenue, New York, has installed a machine for testing some of the mechanical properties of conductors. The rated capacity of this machine, in the measurement of tensile strength, is 15,000 pounds, which is sufficient to break a No. 0000 hard drawn copper wire. By this addition to its equipment the company now has excellent facilities for all such tests of wires and cable as are ordinarily required in electrical practice. These comprise measurements of conductivity, insulation resistance, dielectric strength, electrostatic capacity, tensile strength, elongation, elastic limit, etc.

JOSEPH M. ROMAN & CO., of New York City, engaged in the design and construction of electric and power properties, announce that they have opened offices in Atlanta, Ga., in order to follow more closely their work in the South. Mr. R. W. Hutchinson, Jr., a native Southener, and a close student of and author of several books on power development, transmission and application, enters the firm. The firm has a broad experience in this line of work, holds contracts for several plants now in course of construction, has just completed some electrical transmission work for the U. S. Government, and anticipate a busy future, based on the prosperous condition and bright future of the South. The firm will be glad to receive catalogues and price-lists for the files of its Southern office.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY continue to have an enormous demand for its alternating-current motors of the "CCL" type. The favor with which these motors have been received has surpassed the expectations of the company, and it is a matter of extreme gratification to note the entirely successful operation of the motors, even under the most severe conditions. A large marble plant has recently been equipped, and, although the motors have been operating under overloads and under conditions which require the strongest mechanical construction, their operation has left nothing to be desired. Increase in production and decrease in operating costs, as well as absence of the multiplicity of belts, are among the principal features noted in connection with this installation.

RENDERING PITTSBURG POSSIBLE.—In the office building of the H. K. Porter Company, at Pittsburg, Pa., an apparatus has been installed in connection with the heating and ventilating system whereby the air is washed and all dust and soot removed before it is put in circulation. This device, installed by the B. F. Sturtevant Company, of Boston, Mass., consists of a metal supporting frame filled with coke over which water trickles. All air entering the building is drawn through this filter by means of a fan and delivered under pressure to the various rooms. It is stated that during the past summer the fan has been operated continuously with the windows closed, the air has been thoroughly cleansed, its temperature lowered, the health of the office force improved and their daily output increased.

TRAIN LIGHTING.—The Chicago & Northwestern Railway Company has a new fast train from Chicago to St. Paul and Minneapolis, of a special luxurious character, especially as to lighting and toilet arrangements. The electric lighting arrangements of the train are so complete that it is no less than a brilliantly lighted moving palace. In the buffet-smoking and library car lamps shed a softened flood of light through delicately tinted art glass. In the sleeping cars each berth, compartment and drawing-room is equipped with individual reading lamps, and in the chair cars and day coaches special attention has been given to the subject of lighting, with a row of incandescent lamps on either side of the car, in addition to the usual center lights. The color effect is particularly attractive in the dining cars, where electric candelabra shed a softened glow of light over snowy linen and sparkling crystal.

"LONG-ARM" DOORS.—The Bureau of Construction and Repair of the Navy Department, after severe tests, has approved the new Model C electrically-operated bulkhead door made by the "Long Arm" System Company, of Cleveland, Ohio. The ships for which this door was specifically approved are the the "Montana" and "North Carolina." The tests demonstrated that the door was fully capable of closing through coal, and its watertight qualities were demonstrated under high pressure. The nominal leakage of the doors under this pressure was so small as to give entire satisfaction to the representatives of the Bureau who witnessed the tests. In the course of the evolution of the "Long Arm" System power doors, some minor defects developed in the first models. These defects have been overcome in the Model C door, which is more direct in its operation, simpler in design, and, therefore, easier to keep in good condition than were the earlier models.

SIMPLEX ELECTRIC HEATING EXHIBIT.—Few of the exhibits at the Madison Square Electrical Show, to be held from Dec. 12 to 23, will have a more popular interest than that of the Simplex Electric Heating Company, of 39 Cortlandt Street. Among the displays in the booth of this company will be complete lines of electrical heating apparatus, including electric radiators, chafing dishes, waffle irons, ovens, tailors' irons, coffee urns, glue pots and incubators. These exhibits will be shown in actual operation. For this purpose a model electric kitchen will be furnished where a corps of cooks will practically demonstrate the uses of the products of this company by actually cooking some of the food, including roasts which will be served in the cafe. It is also planned to demonstrate the uses of electricity in baking biscuits and in making coffee, samples of which will be given to visitors. The Simplex Electric Heating exhibit will be in charge of Mr. Roger Williams.

Weekly Record of Electrical Patents.

UNITED STATES PATENTS ISSUED NOV. 7, 1905.

[Conducted by Rosenbaum & Stockbridge, Patent Attys., 140 Nassau St., N. Y.]

803,539. BLOCK SIGNAL SYSTEM; Charles E. Bennett, New York, N. Y. App. filed June 10, 1905. This patent and the one following relate to an unusual block signal system. (See below.)

803,540. BLOCK SIGNAL SYSTEM; Charles E. Bennett, New York, N. Y. App. filed July 11, 1905. The patentee secures an automatic overlap block signal system wholly without use of relays, contactors, tappets or circuit closers of any sort. The rails are charged with alternating-current low potential from step-down transformers, and the high potential primary current is utilized for transmitting the signals. The increased current in such primaries when the secondaries are short circuited by the axles of a passing train, is sufficient to actuate the home and distance signals.

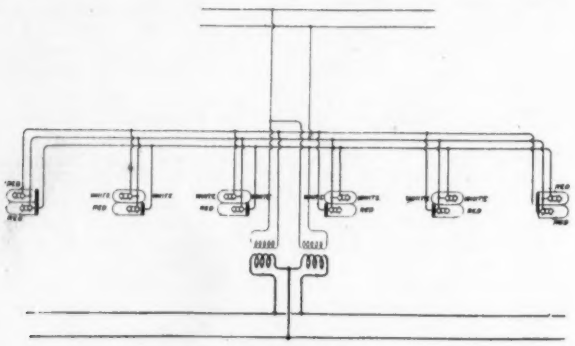
803,543. ELECTROLYTIC PROCESS USING INSOLUBLE ANODES; Anson Gardner Betts, Troy, N. Y. App. filed Feby. 16, 1905.

803,544. APPARATUS FOR REFINING LEAD BY ELECTROLYSIS; Anson Gardner Betts, Troy, N. Y. App. filed March 18, 1904.

803,569. INDUCTION TRANSFORMER FOR WIRELESS TELEGRAPHY RECEIVING STATIONS; Eugene Ducretet, Paris, France. App. filed Mar. 2, 1904. The antenna circuit includes the primary of an induction coil of which the secondary is formed of two parallel windings, each having a free unconnected end. The other ends are bridged across a multiple circuit including the coherer and a local battery and sounder.

803,676. TELEPHONY; Francis W. Dunbar, Chicago, Ill. App. filed Nov. 12, 1904.

803,684. INSTRUMENT FOR CONVERTING ALTERNATING ELECTRIC CURRENTS INTO CONTINUOUS CURRENTS; John Ambrose Fleming,



803,539.—Block Signal System.

London, England. App. filed April 19, 1905. (See Current News and Notes.)

803,704. TELEGRAPHIC SOUNDER; Frank H. Miller, Washington, D. C. App. filed Feb. 18, 1905. A rectangular box is secured upon the usual contact posts of a telegraph sounder in order to constitute a resonator and improve and amplify the quality of the sound.

803,793. INSULATED RAIL JOINT; Reuben W. Smith, Bryn Mawr, Pa. App. filed May 26, 1905. A pair of metal fish plates are so formed as to each closely embrace one rail of the pair to be joined, each plate overlapping the other rail and being separated therefrom by an insulating section.

803,795. ELECTRIC HEATING DEVICE; George E. Stevens, Lynn, Mass. App. filed Feb. 15, 1904. A pair of resistance coils are suspended in a vertical position between a pair of sheet metal plates with which contact is made by specially formed clamping nuts.

803,803. BRUSH HOLDER; Norman C. Bassett, Lynn, Mass. App. filed Mar. 20, 1902. In order to avoid brushes becoming gummed to their holders when cold, and preventing good contact, the patentee makes use of two separate springs, one of which presses the brush holder and the other the brush within the holder.

803,806. TROLLEY WHEEL; Emile Brossy, West Hoboken, N. J. App. filed July 20, 1904. The trolley wheel is made spherical in form with an annular groove to engage the usual conductor. The purpose is to give a stronger construction, one less liable to heat, and in which angular or sharp edges are not presented to catch on guy wires, etc.

803,816. INSULATING MATERIAL; William L. R. Emmet, Schenectady, N. Y. App. filed Nov. 24, 1900. Embodies superposed sheets of asbestos with hard-baked layers of linseed oil and gum copal baked upon one surface of each sheet.

803,817. CIRCUIT BREAKER; Michael B. Field, Sevenoaks, England. App. filed Mar. 17, 1903. An apparatus for breaking the circuits of three-phase high-potential systems. After the main switches have been broken the current is carried by bridges across diverging rods upon a convenient place. The bridges are suddenly removed and the arc travels upward and outward and is finally broken by the divergence of the rods.

803,825. TRIP COIL FOR CIRCUIT BREAKERS; John D. Dilliard, jr., Schenectady, N. Y. App. filed Feb. 13, 1902. Relates to means for calibrating a circuit breaker to respond for different current intensities. Different magnetic cores may be inserted within the magnet coil having different restricted areas at a portion of their length.

803,827. RAILWAY SWITCH STAND CONTACT BOX; William J. Hughes, Levis, Canada. App. filed May 5, 1905. The box contains an insulating plate with a pair of contacts or terminals thereon which are engaged by a spring blade depressed into contact therewith by a movable plunger.

803,832. MOTOR OPERATED SWITCH; Wesley E. Laird, Pittsfield, Mass. App. filed Feb. 16, 1904. In the case of large motor operated switches a danger arises in the event the motor becomes disabled. This patent provides a gravity device which is always effective to throw the switch in case the electric motor is disabled.

803,834. CONTROL SYSTEM; Carl W. Larson, Schenectady, N. Y. App. filed Apr. 17, 1905. The controller arm has a plurality of latches thereon which prevent any movement until they have all been released by their respective electro-magnets. The electro-magnets are controlled by different stops and brake devices insuring the release of all of these before the motors can be started.

803,836. VAPOR ELECTRIC APPARATUS; Alexander D. Lunt, Schenectary, N. Y. App. filed May 12, 1904. (See Current News and Notes.)

803,853. BRUSH HOLDER; Henry G. Reist, Schenectady, N. Y. App. filed Mar. 26, 1904. The brush holders form links of a continuous chain which extends around the contact ring. Each brush holder has a supplemental spring by which its brush is individually pressed toward the commutator or ring.

803,856. TELEPHONE SYSTEM; William A. Robinson, South Kortright, New York. App. filed Feby. 18, 1904.

803,872. SIGNALING ON RAILWAYS, TRAMWAYS, ETC.; John Brown, Dunmurry, Ireland. App. filed Oct. 4, 1901. Relates to a system for transferring passengers to express trains without stoppage of the latter by means of a local train running temporarily alongside. The trains have galvanometers to indicate their proper approach to one another.

803,881. SELF-SOLDERING THERMAL PROTECTOR; Frank B. Cook, Chicago, Ill. App. filed March 26, 1904.

803,895. KNIFE SWITCH; Bird M. Graybill, Chicago, Ill. App. filed Mar. 11, 1905. The contact members of a knife blade switch have spring pressed plugs therein which engage the knife blades and make an improved contact therewith.

803,898. ELECTRIC SWITCH; Arthur E. Handy, Providence, R. I. App. filed Oct. 20, 1904. Details of an elevator controller in which the contacts are supported from an insulating block in the rear thereof, and the cylinder has segments which oscillate into engagement with one or another series of contacts.

803,936. ELECTRIC PUMP; John C. Stokes, Mansfield, La. App. filed Feb. 28, 1905. The pump is operated by a pair of opposed solenoid magnets which are alternately switched into circuit by a quick-acting knife switch actuated by tappets on the pump rod.

803,973. INSULATOR; George M. Bemis, Readsboro, Vt. App. filed June 11, 1904. The insulator comprises two hemispherical blocks which can be dovetailed together to produce a diametral passage therethrough for the wire. The insulator is supported by a fork-shaped fixture.

803,976. AUTOMATIC ELECTRICAL SIGNALING APPARATUS FOR RAILWAYS; Algernon H. Binyon, London, England. App. filed Apr. 26, 1905. Details of an overlap block signal system employing contactors and circuits in which the track rails are energized by continuous currents.

804,021. MEANS FOR PRODUCING OXIDES OF NITROGEN; Ernst Marquardt, Schoenberg, near Berlin, and Hermann Viertel, Charlottenburg, Germany. App. filed May 2, 1903.

804,045. ELECTRIC WELDING CLAMPING DEVICE; Adolph F. Rietzel, Lynn, Mass. App. filed Nov. 16, 1903. A pair of jaws are arranged to clamp the articles to be welded so as to be forced against one another. Each jaw is independently adjustable in all directions so that the articles may be brought into perfect alignment.

804,070. ELECTRICAL FUSE PLUG; George B. Thomas, Bridgeport, Conn. App. filed May 22, 1905. The fuse plug has two parts which can be brought together so as to enclose the fuse cartridge in a cylindrical cavity. The fuse circuit is independently completed at the same time by a pair of studs upon one of the members which engage sockets in the other.

804,077. TELEPHONE-EXCHANGE SYSTEM; Harry G. Webster, Chicago, Ill. App. filed May 7, 1903. (See page 868.)

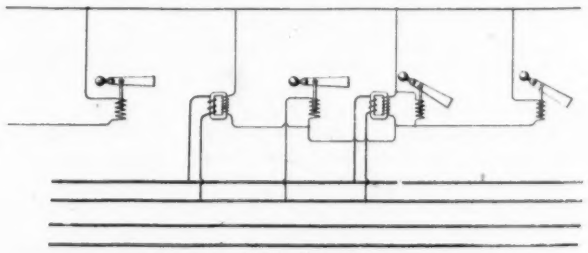
804,082. ELECTRIC CLOCK; Leopoldo Agostinelli, Terni, Italy. App. filed July 31, 1903. The clock train is driven by a weighted lever which is intermittently raised by a magnet periodically energized from a line current. The periodicity is controlled by the clock train.

804,103. TELEPHONE-SWITCHBOARD APPARATUS; Thomas Vivian Davis, Kansas City, Mo. App. filed April 4, 1904.

804,114. ELECTRICAL ROSETTE; Gilbert W. Goodridge, Bridgeport, Conn. App. filed Nov. 21, 1904. The rosette has apertures for a pair of fuse cartridges which are electrically connected into circuit by the assembling of the rosette parts.

804,115. ELECTRICAL INSULATOR; Gilbert W. Goodridge, Bridgeport, Conn. App. filed May 5, 1905. A porcelain insulator of usual form except that the usual annular groove for the wire is made of spiral form and has three straight faces which preclude slipping of the wire.

804,126. RAILWAY SWITCHING AND SIGNALING APPARATUS; Winthrop K. Howe, Buffalo, N. Y. App. filed Mar. 28, 1904. Relates to details of a system for operating railroad signals from a tower. Signals are



803,540.—Block Signal System.

mechanically worked by motors which have their circuits specially controlled.

804,133. ELECTRICAL BINDING SCREW; William Kaisling, Chicago, Ill. App. filed May 22, 1903.

804,156. SYSTEM OF ELECTRIC MOTOR CONTROL; Charles A. Mudge, New York, N. Y. App. filed Mar. 2, 1905. A complete multiple unit system in which the operator works a pair of valves through electro-magnets which admit fluid pressure to the respective ends of a cylinder which turns the controller to its various positions for each car upon the train.

804,176. SYSTEM OF AUTOMATIC SIGNALING FOR ELECTRIC RAILWAYS; Fitzhugh Townsend, New York, N. Y. App. filed Aug. 1, 1905. The rails are charged with a low potential A. C. current and whenever a train passes it closes a separate circuit through a transformer which steps up the current to an amount sufficient for operating the signals.

804,180. SELF-RESTORING SIGNAL CONTROLLING DEVICE; Eugene W. Vogel, Chicago, Ill. App. filed July 23, 1901. In order to prevent waste of current in those cases where an alarm bell is rung during the time the train is on a block section a switch is provided by which such circuit can be opened when desired.

804,182. METALLIC CIRCUIT FOR OPERATING SIGNALING DEVICES; Albert Koch Andriano and Hermann Herbstritt, San Francisco, Cal. App. filed March 6, 1905.

804,189. APPARATUS FOR MEASURING THE LENGTH OF ELECTRIC WAVES; John A. Fleming, London, England. App. filed Feb. 8, 1905. The antenna circuit of a wireless system is connected to the end of a coil, the earth connection from the other end of which can be moved to variable positions thereon. When a position is found where the resonance agrees with the periodicity, the potential takes nodes and loops along the coil which can be investigated with a vacuum tube. The wave length can be determined from the active length of the coil.

804,190. INSTRUMENT FOR MAKING ELECTRICAL MEASUREMENTS; John A. Fleming, London, England. App. filed Feb. 8, 1905. Relates to details of construction of a wave length measuring coil of the character mentioned in the preceding patent.

12,406. DIRECT-CURRENT DYNAMO ELECTRIC GENERATOR; Benjamin G. Lamme, Pittsburg, Pa. App. filed May 2, 1905. Relates to means for overcoming defects of balance of the field forces by the employment of a balancing alternating-current connected to points of the armature circuits.